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DRUGS AND HUMAN FATIGUE: GSR PARAMETERS*

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A. PROBLEM

If the rapid advances underway in pharmacologic dissection of the central nervous system are to be applied in maintaining human effectiveness, both a working definition of the fatigue state and a laboratory equivalent of fatigue effects are necessary. In broadest definition, fatigue is the decompensation of a response pattern relative to some stimulus. This definition is general enough to cover all cases of fatigue, extending from the isolated nerve-muscle preparation, after repetitive shocks, to psychic boredom of the intact human subject. While such a comprehensive definition satisfies most examples, it is too broad to be handled experimentally. The quantitative study of human fatigue depends on finding an appropriate and measurable response. This paper suggests that fatigue may be measured by use of the galvanic skin reflex (*GSR*) and illustrates the shifts in *GSR* response patterns under prolonged wakefulness and drug-simulated fatigue. The *GSR* is a particularly appropriate measure if central fatigue is, as we think, relative decompensation of the neurophysiological arousal mechanism. Recent experimental work (1) seems consistent with this concept.

The precise penalty of fatigue in daily tasks, either military or civilian, has been difficult to measure by behavioral experiments. Mere suspicion that he is the object of a study will "arouse" a subject and completely alter his pattern of behavior. Indeed, alerting of the subject by the very testing procedure designed to measure his state of alertness has long been a frustrating experience of the experimental psychologist (2). Measuring the state of consciousness against such bioelectric criteria as the *GSR* introduces very little "measurement stress" into the experimental situation.

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¹This paper is a condensed version of a presentation to the Advisory Group for Aeronautical Research and Development, N.A.T.O., at Oslo, Norway, in May 1956. The complete paper is to be published under the auspices of N.A.T.O. in the "AGARDograph." This research began at the Aero Medical Laboratory, Wright-Patterson Air Force Base, and continues to be supported by the United States Air Force, through the Air Force Office of Scientific Research and the Aero Medical Laboratory, Wright Air Development Center, Air Research and Development Command.

B. CHARACTERISTICS OF THE *GSR*

In the past several years the Aero Medical Laboratory, Wright-Patterson Air Force Base, has developed improved instrumentation for the recording of the *GSR*. This measure has been used to quantitate arousal to a standardized stimulus (3). A very mild electric shock, the "standard stimulus," is applied to the right ankle. The *GSR* is recorded from thin plates on the soles of both feet as a transient change in resistance to an impressed constant current.

Several different aspects of the *GSR* have been delineated, but of particular interest in the study of fatigue are the specific and non-specific responses. The specific response is measured as an amplitude per cent, taking the *GSR* amplitude during a control period as 100 per cent. The specific *GSR* is an "evoked" response to a well-marked stimulus delivered through specific neurophysiological pathways.

A second aspect of the *GSR*, which we have called non-specific, is measured as the number of responses per unit time which occur due to internal stimuli, or to subliminal external stimuli not apparent to the observer. This is the "background" activity which has been largely dismissed as spontaneous or endogenous responses by other investigators. The non-specific activity has maintained a direct relation to pharmacologic activation or depression of the non-specific reticular activating system of the brain (4).

During drowsiness and sleep, both specific and non-specific responses disappear. With increasing arousal, the specific responses increase in amplitude and the non-specific activity becomes increasingly more frequent. Excessive stress or anxiety may once again abolish specific responses, while the number of non-specifics continue to increase. An important exception to the "bell shaped" change of specific *GSR* amplitude with progressive arousal is found during very light sleep or deep drowsiness. In this zone the specific *GSR* rises to a paradoxical spike with amplitude that may be many times control level. This over-response may occur even to stimuli which ordinarily would not evoke a *GSR*.

C. DRUG SIMULATED FATIGUE

Figure 1 illustrates the specific and non-specific *GSR* pattern in a subject given I.V. pentobarbital to the point of sleep, and subsequently aroused with I.V. Metrazol (pentamethylentetrazol). The quantity of Metrazol was not sufficient to balance the pentobarbital effect. Insofar as central fatigue may be related to depression of the arousal mechanism, any drug which depresses this system can be said to partially simulate fatigue. Indeed,

the clinical use of barbituates which do depress this system is predicated on their "fatigue-like" action. On the other hand, such classical anti-fatigue drugs as amphetamine have been demonstrated to have a highly stimulating neurophysiological action on these centers (5).

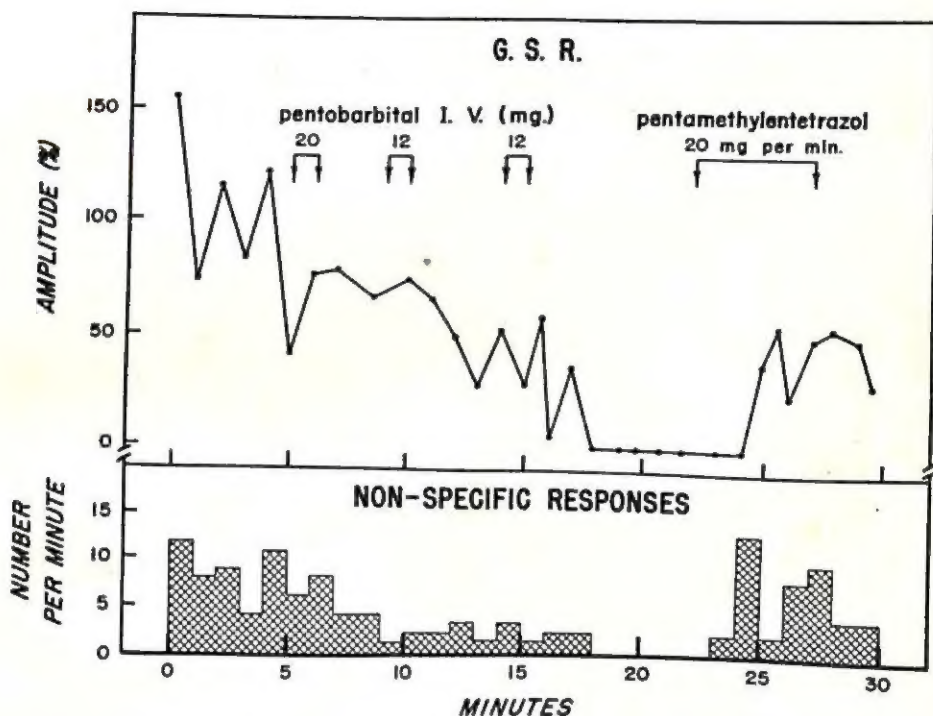


FIGURE 1

Small doses of a sedative were administered to a reclining normal subject via intravenous fluid flowing from the next room. Non-specific *GSR* waves, then specific *GSR*, and finally psychomotor behavior disappeared. Arousal by Metrazol (pentamethylentetrazol) restored all three measures of consciousness.

D. PROLONGED WAKEFULNESS FATIGUE

While selected drugs can simulate certain aspects of fatigue, as well as certain aspects of stress, the most powerful laboratory tool for inducing a "natural" fatigue state remains the prolonged wakefulness run. In the fatigue of prolonged wakefulness, we find two distinct trends in specific responses.

Figure 2 illustrates the occurrence of fatigue in a 56-hour, prolonged confinement run. There is a gradual downward trend of the amplitude of the

specific *GSR* to electric shock with time; both during sleep and toward the end of the continuous performance period, specific responses disappeared. The subject's own evaluation of his state of consciousness as "alert" in the last hours of continuous performance did not agree with the *GSR* and psychomotor evidence of depression. Generally, it has been found that subjective evaluation shows a high correlation with bioelectric measurements

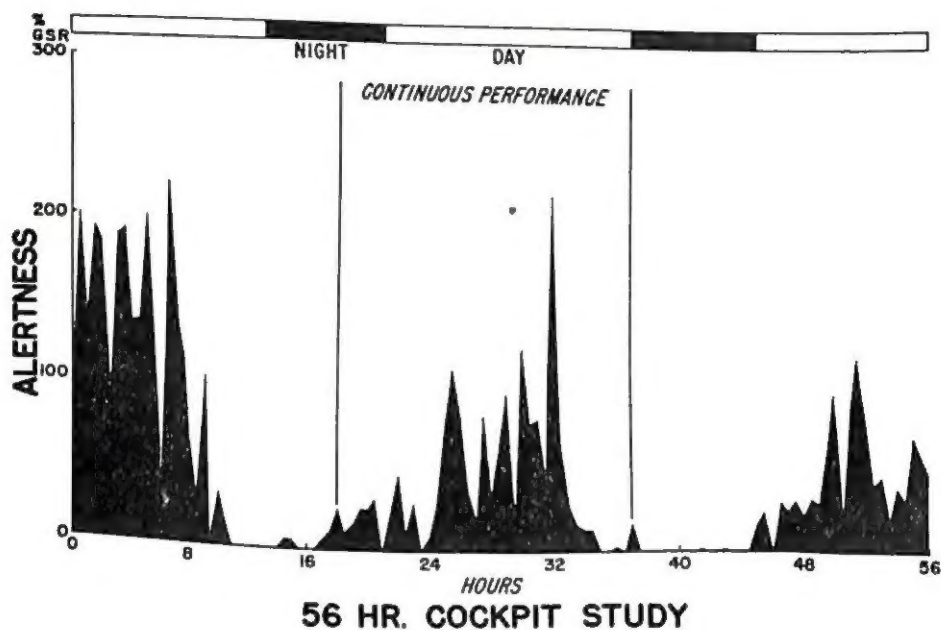


FIGURE 2

Specific *GSR* response represented as a measure of the sampled alertness of three subjects, each isolated for three days and two nights. Toward the end of each continuous performance (from 18th to 37th hour) the specific *GSR* dropped sharply, though the subjects claimed continuing alertness, and gross psychomotor performance was maintained until the last several hours of this period.

during control periods and the earlier portions of fatigue runs. However, as the subject becomes fatigued through prolonged wakefulness, his ability to evaluate his own state of consciousness begins to break down.

Figure 3 is a chart showing the results of a 15-subject, 30-hour prolonged wakefulness test, in which two drugs were checked for their anti-fatigue action. In the control group, the fall in non-specific activity was not paralleled by depression of specific *GSR*. Instead, there was a mirror image with over-response of specifics to the standard stimulus. This is an example of a second type of fatigue pattern, which is produced in an active social

situation with continued arousal and pressure for performance by supervisors and other members of the group. As can be seen, the amphetamine-treated group showed a fall (but not a marked deterioration) in specific responses to the standard stimulus, while at the same time the non-specific

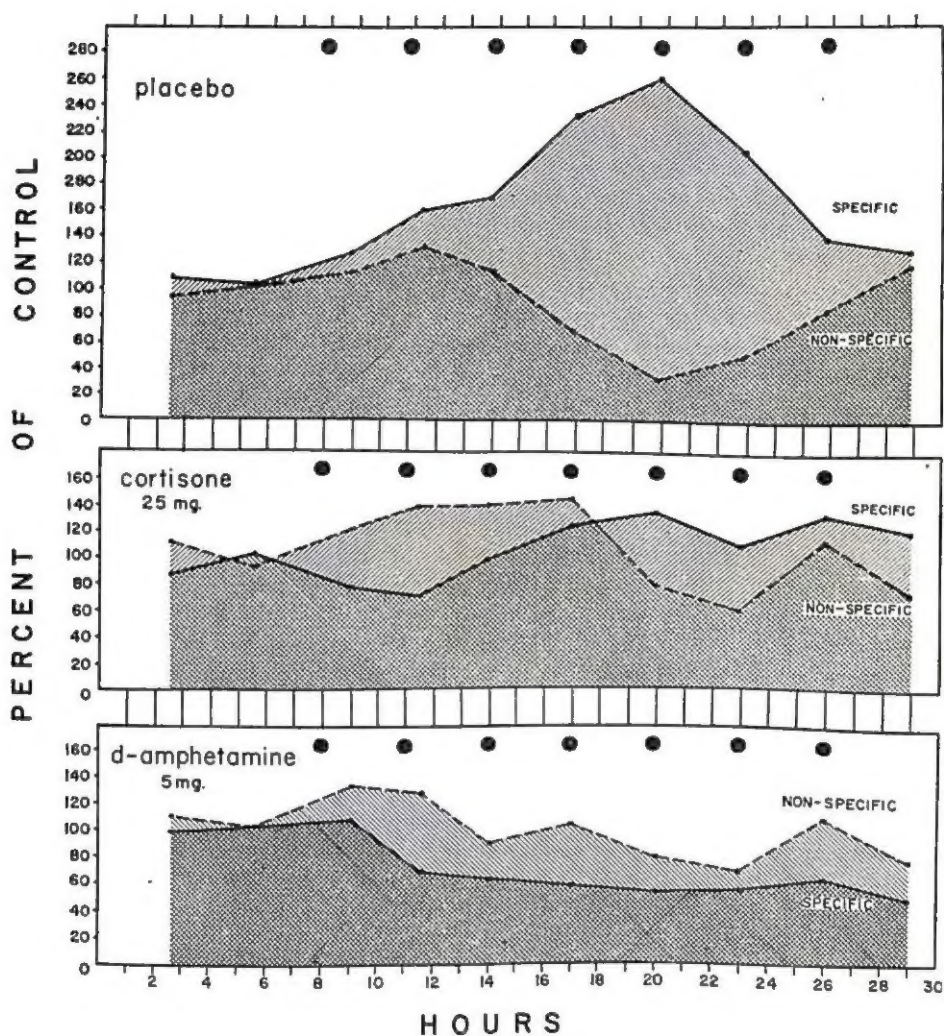
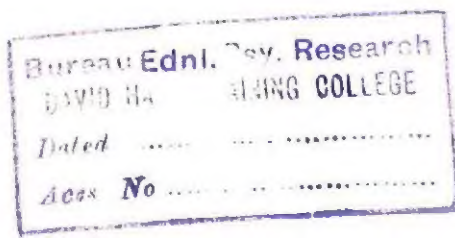


FIGURE 3

Drug protection against the fatigue of prolonged wakefulness, as indicated by several GSR records. Oral doses were repeated every three hours. That degree of arousal can be maintained is shown by the non-specific GSR. Likewise, the cortical release of Class II fatigue (high specific GSR) evident in unprotected subjects, was averted by drug administration.



GSR or arousal level was continuously maintained. The effects of cortisone were particularly striking in that the specific responses were maintained at a good level without evidence of excessive arousal.

E. INTERPRETATION

In Figure 4 we have designated the two types of fatigue patterns as Class I and Class II fatigue. The non-specific *GSR* shows a progressive depres-

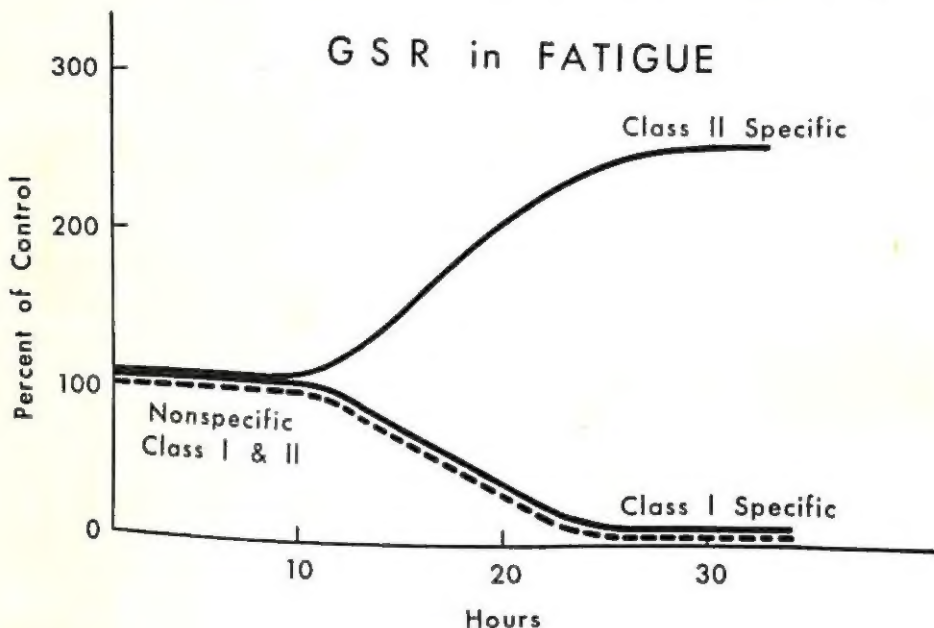


FIGURE 4

Diagrammatic summary of many experiments that produced central nervous fatigue by prolonged wakefulness. The dotted line indicates the consistent disappearance of non-specific *GSR* waves, though specific *GSR* may either decline or increase sharply. Amplitude increase of the specifics may be related to the "paradoxical spike" of very light sleep as described in text.

sion with prolonged wakefulness in both classes. However, the *GSR* response to the standard stimulus may either become depressed, as in sleep (Class I), or may become grossly potentiated, as if the subject had entered a state of hyper-excitability. This pattern of excessive response to stimulus, which we have called Class II fatigue, is probably a reflection of the "paradoxical spike" of light sleep. Furthermore, *GSR* "excitability" was paralleled by behavioral excitability, seen as excessive laughter, expansive hypomanic behavior, and sometimes increased irritability. Such a phase in

fatigue has been described (2), and is probably best understood as a cortical release phenomenon, which may progress to the point of mild depersonalization and hypomanic behavior. The GSR classification of Class I fatigue is of the "retard" type, approximating sleep, which may precede or alternate with Class II fatigue of the "release" type. As a working hypothesis, we regard central fatigue as depression of reticular formation activity resulting from excessive stimuli per unit time, or chronic stimuli of excessive duration; this depression is reversible to an extent, if additional stimuli of adequate strength are introduced.

The converse of fatigue is excessive activity of the arousal system, and such excessive or excessively prolonged stimulation is the neurophysiological reflection of stress. This corresponds to the early stage of Selye's classical definition of stress (6); it corresponds more particularly to the mechanisms of central nervous and autonomic arousal in the "alarm reaction" phase of stress. It should be clear that, as a constant stressor agent continues to impinge on an organism, the central nervous system economy will progressively accommodate and tend to shift the degree of arousal. This is another way of saying that stress, if prolonged enough, will produce both behavioral and neurophysiological manifestations of fatigue.

F. CONCLUSIONS

Data reported here from clinical, pharmacological, and bioelectric fatigue studies suggest a basis for psychophysiological interpretation of fatigue as an altered state of consciousness. Fatigue can be treated within the neurophysiological framework of arousal and categorized as Class I (Retard) and Class II (Release) patterns. Such treatment provides many operational variables that can be handled experimentally, and measured with peripheral recordings. Utilizing bioelectric criteria, the extent of fatigue simulation or protection against fatigue can be determined for any particular drug.

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THE "DYNAMIC-AFFECTIVE" PHASE IN THE DEVELOPMENT OF CONCEPTS*

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A. PROBLEM

The starting point for the present research was Professor Werner's opinion that "we must not frame the question to ask: 'At what age level does concept formation first come into existence?' Rather, we must ask: 'What are the different function patterns underlying the concept formation which appears at different age levels?'" (5, p. 216).

One possible answer is that in some cases the first phase in the development of concepts is dynamic-affective. That is to say, an undeveloped person does not distinguish between himself as perceiving subject and the environment as object. The objects in this primitive perceptual world are affective, signal-and-action things whose characteristics are determined by the condition of the perceiver, not by their physical properties or relationships to other objects. In the present study we have tested this possible answer to Professor Werner's query in the form of the hypothesis that, in some cases, a concept exists only in terms of this dynamic-affective phase. The hypothesis has been examined with the concepts of "Happy," "Harmonious," "Living," and "Conscious."

B. REVIEW OF EXPERIMENTS ON "HAPPY" AND "HARMONIOUS"

1. *Happy*

As the experiment made with the concept "Happy" is reported elsewhere in detail (1), only a brief summary will be given here. In this experiment, the subject's ability to recognize expressions was studied by showing them three drawings of girls, one of which was happy, one miserable, and the third one expressionless. The subject's task was to point out the happiest girl. In the critical experiment, the dress of the unhappiest girl was changed to red whilst the other girls' dresses remained dark blue. When this was done, a large number of children and older country people, who in the first

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part of the experiment were able to recognize the expression "happy" correctly, now chose the unhappy girl in a red dress as a "happy" one. Here an interesting change in their attitude occurred. They mixed up their own feeling of joy, produced by the red colour, with the reality they had to perceive.

2. *Harmony*

This experiment was conducted with water colours in Helsinki using 31 seven-year-old school children and 25 teachers as subject groups. Six coloured sheets were used. On three sheets there were two groups of colours, one group contained pastel colours, and the second group contained the same colours in saturation, with one colour still in pastel. On the other three sheets the relationships of colours was reversed, in one group all were pastel colours except one which was saturated, and in the other group all the colours were saturated. The subject was asked in an individual experiment: "Here you see two groups of colours. In each group there are four colours. Where, here or here, do you think the colours match better together? Where are they more harmonious?" If the task was not understood, the subject was then asked: "Where do the colours look nicer, here or here, when they are all together?" Using coloured strips of paper the subject's colour preference was determined. From the children, 80 per cent preferred saturated colours, whereas 90 per cent from the teachers preferred the pastel colours. Similarly, in the first part of the experiment, the children chose the gaudy unbalanced patterns as more harmonious, as they preferred a particular colour and ignored the colour which did not suit the group as a whole; on the other hand, the adults chose the pastel colours. In the second part of the experiment, the answers of both groups tended to favour the saturated colours. The answers of children showed that the particular colour they liked dominated the selection of what was a harmonious group.

Several experiments have been conducted on the change of the colour preference in children, and the author would like to point out that no change in the preference of particular colours with mental development is so obvious as the change from the preference of saturated colours to the preference of pastel colours. Moreover, one has to remember that when psychologists suggest, as some have, that young children prefer certain hues, red, blue, etc., there are several nuances in each hue, some of which may be more favoured by primitive persons than others. Pointing only to a colour "red," "blue," etc., as a group name, is misleading.

C. EXPERIMENTS ON "LIVING" AND "CONSCIOUS".

1. Purpose

The purpose of these experiments is to show that the affective element goes through all the stages of "alive" as they are defined by Piaget (2) and later on experimentally proved by Russell and Dennis (3). The child belonging to Stage I considers everything to be living which is in good condition. In Stage II, only moving objects are living, and in Stage III, objects are living if they move on their own account. In Stage IV, living is restricted to animals and human beings and plants. Further, the purpose is to show that the dynamic-affective element can determine what a child considers as being "conscious" and what not.

2. Subjects

Experiment took place in the High Gate Primary School in London. Two groups of subjects were used, bright children and dull ones, as defined by teachers. The ages of the children and numbers can be seen in Table 1.

TABLE 1
SUBJECTS USED IN THE EXPERIMENT UPON "LIVING" AND "CONSCIOUS"

Age	Bright children			Dull children			Total
	Boys	Girls	Total	Boys	Girls	Total	
8-year-olds	8	6	14	8	6	14	28
7-year-olds	8	9	17	9	10	19	36
6-year-olds	8	7	15	9	9	18	33
5-year-olds	7	8	15	10	8	18	33
Total	31	30	61	36	33	69	130

3. Procedure and Results

a. "Living." The experiment was conducted individually with each child. He was asked whether he knew what "alive" and "dead" meant. The experimenter then explained, using Russell's instruction, that a cat is alive, but if a motor car runs over it, it dies and is no longer alive but dead. After that the child was asked whether he, the teacher, and the experimenter was alive. The same question was repeated with respect to a stopwatch and a moving mechanical car. The purpose of these preliminary questions was to discover which stage of "Living" the child belonged to.

In the experimental setting the aim was to show that a child regards objects to be alive if he likes them and dead if he does not like them, and that this affective attitude goes through all the four phases of "Living."

(1). Stage I. Fourteen pairs of inert objects were used, one member

TABLE 2B
CASES WHEN ONE MEMBER OF THE PAIR IS SEEN AS MORE LIVING THAN THE OTHER

CASES WHEN ONE MEMBER OF THE PAIR IS SEEN AS MORE LIVING THAN THE OTHER																						
Intelligence Age	Liked member more living											Not-liked member more living										
	Bright					Dull					Total	Bright					Dull					Total
	8	7	6	5	Total	8	7	6	5	Total		8	7	6	5	Total	8	7	6	5	Total	
<i>Inert objects</i>																						
Bottles	0	0	1	2	3	2	2	4	6	14	17	0	0	0	1	1	0	1	0	0	1	2
Spades	0	0	2	2	4	2	1	4	4	11	15	0	0	0	1	1	0	1	0	0	1	2
Rings	0	0	2	3	5	3	2	5	4	14	19	0	0	0	1	1	1	0	0	2	3	
Thimbles	0	0	2	2	4	4	2	3	5	14	18	0	0	0	1	1	1	0	0	2	3	
Eggs	0	0	2	2	4	2	1	5	4	12	16	0	0	0	1	1	0	1	1	0	2	3
Silk coils	0	0	1	2	3	4	3	5	5	17	20	0	0	0	1	1	1	0	0	0	2	3
Buttons	0	0	1	2	3	2	2	4	4	12	15	0	0	0	1	1	0	0	0	0	0	1
Dress decorat.	0	0	2	2	4	3	3	2	5	13	17	0	0	0	0	0	0	1	0	0	0	1
Chains	0	0	2	2	4	2	3	4	3	12	16	0	0	0	1	1	0	0	0	0	1	1
Ribbons	0	1	1	3	5	2	4	3	4	13	18	0	0	0	0	0	0	1	0	1	2	2
Strings	0	1	1	3	5	1	3	4	3	11	16	0	0	0	0	0	0	1	0	1	1	1
Hair clips	0	1	1	3	5	2	2	4	4	12	17	0	0	0	0	0	0	0	0	0	0	0
Papers	0	0	2	3	5	3	3	4	4	14	19	0	0	0	0	0	0	1	0	1	2	2
Gloves	0	0	1	2	3	2	2	4	3	11	14	0	0	0	0	0	0	0	0	0	0	0
Total												237	0	0	1	0	1	0	1	0	0	2

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S. HONKAVARA

of the pair being plain in colour, but the other very gaudy, e.g., the first pair were bottles, one of them a common medicine bottle, but the other one nicely painted. The objects used in pairs, one ugly and one beautiful, were: bottles, spades, rings, thimbles, eggs, silk coils, buttons, dress decorations, chains, ribbons, strings, hair clips, strips of papers and gloves. The pair (e.g., bottles) was put on the table and the child was asked: "Which of these two bottles do you like best?" After that he was asked: "Is that bottle alive or not?" The same question was repeated pointing to the second bottle. If the child said both of the bottles were alive, he was asked whether one of them was more alive than the other or whether they both were equally alive. The order of the questions varied to eliminate possible suggestion on the part of the experimenter. Sometimes the experimenter started by asking whether one of the two objects put on the table was alive or not, and after that first came the question of liking. The order of the questions, however, seemed not to have any effect on the answers. Table 2 (*A* and *B*) gives the answers. The liked member of the pair was seen as alive or as more alive than the disliked member in an overwhelming number of cases, and this relation is stronger in the dull than in the bright group.

(2). *Stage II*. If the child insisted that the objects shown were dead, the experimenter took both of them in her hand and moved them, asking: "Are they now alive or dead?" Then it was asked whether one of them was more alive than the other or whether they were equally alive. Table 3 (*A* and *B*) gives the results. Cases when one member was now seen as alive and the other as dead, were rather few, but the liked objects were again seen as more "alive" than the not liked ones.

(3). *Stage III*. Two mechanical moving cars were used. They were quite the same, except that one of them was nicely painted and the other one ugly and dirty. They ran, side by side, on the table, and the child was asked the same kind of questions. Table 4 (*A* and *B*) shows that some children belonging to Stage III insisted that the liked car was more "living" than the not liked one, but most of the children belonged to Stages I and II and correspondingly regarded the cars as "alive" as they had done for other objects.

(4). *Stage IV*. The experimenter put a sack over her shoulders and asked: "Am I alive or not?" As Table 5 shows a good many of the children maintained that the experimenter was then dead. Most of the children belonged to Stages I-III and correspondingly regarded human beings in the same way as other objects, but three of the children seemed to belong to Stage IV, being an interesting example of how a highly developed concept can be re-

duced back to its primitive origin, making necessary alterations in the experimental situation. Table 5 gives also the cases when the experimenter was seen as "dead" with a silk scarf and in a common dress. Some children did not like the scarf, either, and therefore regarded the experimenter to be "dead" with it.

The results were similar when the experiment was conducted in a remote countryside in Finland. It thus seems that the phenomenon studied is independent of cultural influence.

That it was the dynamic-affective factor and not possibly the signal value of the gaudy colours, etc., which caused the phenomenon, is proved by the fact that the most liked object was not always the gaudy one. If the ugly object was liked best, it was seen as living in the undeveloped mind. Correspondingly, if the two objects were both liked as much, then there was a tendency for them to be regarded as equally "alive."

b. "Conscious." It is Piaget's opinion that the concept of consciousness develops through the same stages as the concept of "living" (2). Russell has again shown this to be true (4). In this experiment, the purpose was to see whether the affective element has any influence here, and it was conducted in connection with the previous Experiment (a) on "Living." The experimenter touched the child's hand and said: "When I touch you, you feel my touch, don't you? When I touch this bottle, does the bottle feel that I touch it or not?" If the child answered that both of the bottles felt the touch it was asked whether one of them felt it more than the other or not. In Stage II, the experimenter took the bottles in her hand, moved them and asked: "Do the bottles now feel that I move them or not? Which of them feels more or do they both feel the same touch?"

The results were the same as the "Living" being in question. With respect to the moving objects (cars), only children belonging to Stages I and II showed affective reactions here. The corresponding tables of results are omitted.

4. Discussion

In the experiment on "living" and "conscious" we have tried to show that there is a tendency in children to regard a liked object to be "alive" and "conscious" and a disliked one to be "dead" and "not conscious." This phenomenon reminds us of the behaviour of some primitive people. In Bantu language, for example, there is a class of persons and also a class of things. But all persons who are in any way contemptible or unworthy are relegated to the class of things. The blind, the deaf, the crippled, and the idiot all

TABLE 3B
CASES WHEN ONE MEMBER OF THE PAIR IS SEEN AS MORE LIVING THAN THE OTHER

ONE MEMBER OF THE PAIR IS SEEN AS MORE LIVING THAN THE OTHER																						
Intelligence Age	Liked member more living										Not-liked member more living											
	Bright					Dull					Total	Bright					Dull					Total
	8	7	6	5	Total	8	7	6	5	Total		8	7	6	5	Total	8	7	6	5	Total	
<i>Objects moved</i>																						
Bottles	0	3	1	0	4	3	2	0	1	6	10	0	1	0	0	1	0	0	0	0	1	
Spades	0	0	1	0	1	0	1	0	0	1	2	0	0	0	0	0	0	1	0	0	1	
Rings	1	2	0	0	3	2	1	0	0	3	6	0	0	0	0	0	1	0	0	1	1	
Thimbles	1	1	0	0	2	1	2	0	0	3	5	0	1	1	0	0	1	0	0	1	1	
Eggs	1	0	0	0	1	2	2	0	0	4	5	0	1	1	0	2	0	1	0	0	3	
Silk coils	1	0	1	0	2	2	2	0	0	4	6	0	1	1	0	2	0	1	0	0	3	
Buttons	1	1	0	0	2	0	2	0	0	2	4	0	0	0	0	0	0	0	0	0	0	
Dress decorat.	1	1	1	0	3	0	2	0	0	2	5	0	0	0	0	0	1	0	0	1	1	
Chains	1	0	0	0	1	2	1	0	0	3	4	0	0	0	0	0	1	0	0	1	1	
Ribbons	1	0	1	0	2	1	2	0	0	3	5	0	0	1	0	1	0	2	0	2	3	
Strings	0	0	0	0	0	2	2	0	0	4	4	1	0	0	0	1	1	0	0	1	1	
Hair clips	0	1	0	0	1	1	2	0	0	3	4	1	0	0	0	1	1	0	0	2	3	
Papers	1	0	0	0	1	1	3	0	0	4	5	1	0	0	0	1	0	1	0	1	2	
Gloves	1	0	0	0	1	1	1	0	0	2	3	0	0	0	0	0	0	0	0	0	0	
Total											68										21	

8-326
3.9.70

TABLE 5
"LIVING": STAGE IV (HUMAN BEING)
Cases When a Human Being Is Seen as Dead

Intelligence Age	With sack								Total	With scarf								Total	In common dress								Total
	Bright				Dull					Bright				Dull					Bright				Dull				
	8	7	6	5	8	7	6	5		8	7	6	5	8	7	6	5		8	7	6	5					
<i>Belonging to</i>																											
Stage I	0	2	1	1	4	2	4	4	18	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	
Stage II	0	2	0	0	1	4	0	1	8	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Stage III	0	0	1	0	1	0	1	2	5	0	0	1	0	0	0	1	0	2	0	0	0	0	0	0	0	0	
Stage IV	0	0	0	1	1	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	
Total									33									6									1

belong to this thing-like class. The language of the Algonquin Indians often put small animals into the class of inanimate objects, whereas large plants are often placed in the class of animate things (5, p. 233).

The dynamic-affective behaviour noticed in the experiment on "Living" in children seems to be independent of cultural influence, so that it may be a deep developmental phenomenon which can also appear in the behaviour of primitive adults. The examples quoted suggest this hypothesis.

D. SUMMARY

We started with Professor Werner's statement that in the study of the development of concepts one has to ask: "What are the different function patterns underlying the concept formation which appear at different age levels?" A hypothesis was suggested that in some cases the first phase in the development of concepts is dynamic-affective, i.e., the subject's own likes and dislikes determine how he comprehends the concepts. The concepts do not exist separate from the perceiving subject, but belong to the diffuse combination of the ego-centered subject and his environment. In the experiments, this is shown to be true with the concepts "Happy," "Harmonious," "Living," and "Conscious." In the experiment with the expression "Happy," undeveloped subjects became "blinded" by the colour red added and chose a miserable girl as a happy one, because they liked the colour of her dress. In the experiment with the concept "Harmonious," on the other hand, children experienced unbalanced groups of colours as "harmonious," if they liked some particular colours in them. "Living" is a concept which is influenced by the undeveloped subject's likes or dislikes. A liked object is seen as "living" and a disliked one as "dead." The same dynamic-affective element goes through all the four stages of "living" as stated by Piaget and experimentally proved by Russell and Dennis. Signs of dynamic-affective behaviour were found also in the experiment on the concept "Conscious," but in this experiment we succeeded in eliciting it only in Stages I and II.

It is to be hoped that other research workers will continue the study in order to discover whether the same dynamic-affective behaviour appears with regard to other concepts.

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Nurses' Home

Metropolitan State Hospital

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A CRITICAL REEVALUATION OF THE COLOR AND FORM REACTION, AND DISPROVING OF THE HYPOTHESES CONNECTED WITH IT*

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A. INTRODUCTION

1. *The Status Quo*

A color reaction, as contrasted to a form reaction, is regarded as a sign of inferiority in a personality. There are two sources from which this opinion has come: (a) The experiments by Descoeudres (1), Katz (3), etc., who showed that color choices increased with decreasing chronological age. The inference drawn by these writers: It is a sign of primitivity and characteristic of children. (b) Rorschach interpreted color reaction as a sign of unbalanced emotionality, i.e., neurosis.

Except for children, color reaction is usually considered to be more common among women than among men.

2. *The Hypotheses Tested in This Study*

a. A seemingly color or form reaction can in reality be a choice based purely on preference (liking or disliking) and not on color or form as such. A person who has repeatedly given only form responses can change over to a "color" response if the color is liked or disliked by him. On the other hand, a color reactor can change over to a "form" reaction, if the form pattern used is in a liked or disliked color.

b. Color and form reaction is connected with intelligence and general mental development, but quite contrary to the present theories, form reactors are more common among people with low intelligence than among people with high intelligence.

c. Women are more often form reactors than men.

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¹In conducting the experiments reported in this paper the author has been financially supported by the Central Research Fund of London University and by Alfr. Kordelin's Foundation in Finland.

B. EXPERIMENTAL PROCEDURE AND RESULTS

1. *Subjects*

The experiment was started in London during the last winter. During the last summer it was partly repeated in Finland. Table 1 gives the subject groups in both countries. In England, the children were divided into different forms according to their school success and group intelligence tests.

TABLE 1
THE SUBJECTS USED IN THE COLOR OR FORM TESTS

Age	Subject group	Males	Females	Total
<i>Subjects in England</i>				
	University students	31	40	71
	10-11-yr. upper class school:			
	Form A	14	28	42
	10-11-yr. mixed class school:			
	Form A	22	21	43
	Form Higher B	22	10	32
	Form Lower B	19	13	32
	Form C	18	18	36
	7-9-yr. mixed class school:			
	Form Lower B	9	21	30
	Form C	9	6	15
	Total	144	157	301
<i>Subjects in Finland</i>				
	Some school education	17	43	60
	Uneducated	44	41	85
	10-18-yr. adolescent	10	18	28
	7-9-yr. children	19	14	33
	Total	90	116	206

Form *A* is the most intelligent group, and Form *C* the lowest in intelligence. Form *A* was studied in two different schools; one of them, the Hampstead Garden Suburb Primary School, is a very upper class school socially, and the other one, the Highgate Primary School, contains children from different social classes.

In Finland, no grouping with intelligence was possible to arrange, as the schools were closed. The difference between uneducated people and the ones who have had some school education does not mean the corresponding difference in intelligence (since school education has been largely dependent on the wealth of the parents).

2. *Proving the Hypothesis That a Factor of Preference Has an Influence in the Color or Form Choice*

From a large selection of strips of colored paper, glued on a sheet of cardboard, the subject has to choose a color he likes best, the one he dislikes, and

then two colors he is indifferent to. After the naming of the colors, other tests are used, before going to a color or form test.

It is a variation of a test used by Katz (Figure 1). The patterns are first in the two indifferent colors. The instruction: "Shut your eyes. Now you may open them. Which of these things are most like the one here (the model), in your immediate quick reaction?" If the subject chooses according to the color, the color patterns remain the same, but the form patterns are changed, first into the best liked color, then into the least

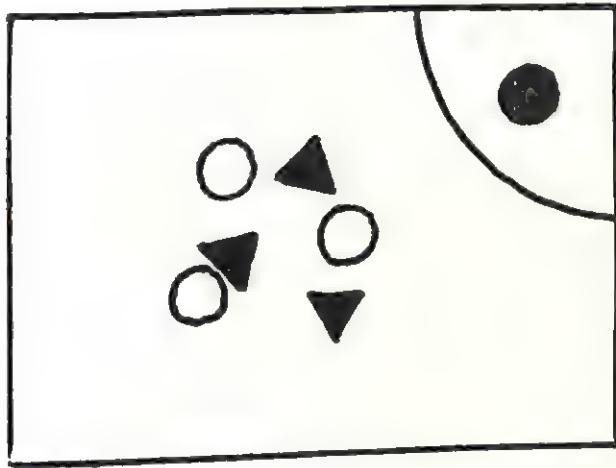


FIGURE 1
KATZ' MODEL OF COLOR OR FORM TEST

liked color. If he chooses according to the form, the form patterns remain the same, but the color patterns are changed, first into the most liked color and then into the least liked one. Then the patterns are again placed on the table in the indifferent colors, but now reversing the places, and the same procedure follows as earlier.

This test was used only in England. Figure 2 (*A* and *B*) gives the results. Two points are of interest here: (*a*) The percentage of subjects who change with preference from a color reaction to a form one, or vice versa, decreases with decreasing intelligence. (*b*) The percentage of subjects who gave only form responses increases with decreasing intelligence. The answers of the 7-9-year-old children with low intelligence seem to be contrary to these results, but we have to take into account that in the youngest subject group we are approaching the point where the task becomes meaningless and the children start to give haphazard answers.

3. *The Principles on Which the Main Color or Form Test Is Built*

As it is complicated to ask each person's preference with respect to colors and to use these colors in the test with him, the writer planned a test which allows the display of preference but in a large and more common scale. In a previous article in this journal (2), the writer has reported an experiment on color preference and stated that children and undeveloped adults prefer strongly saturated colors, but that with mental development the pastel colors

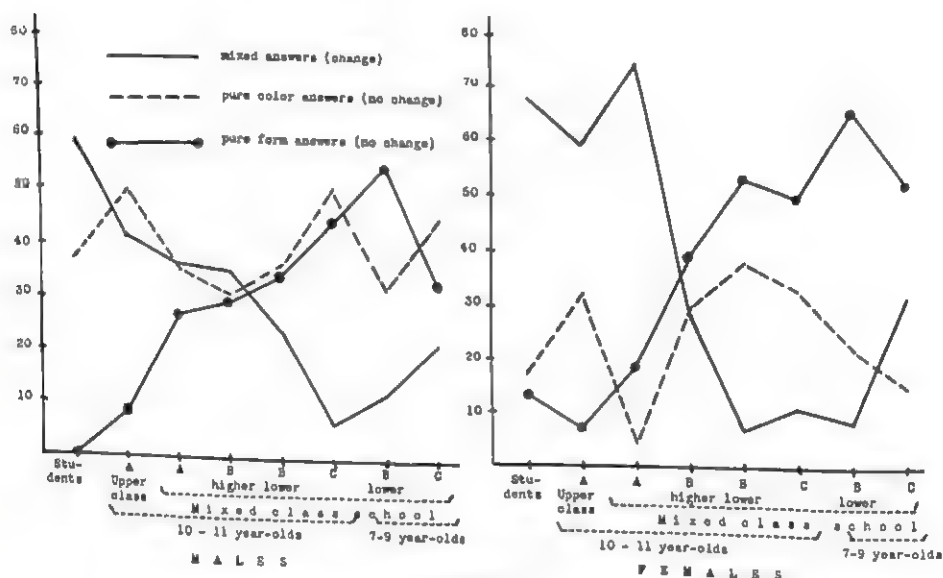


FIGURE 2

THE RESULTS IN KATZ' MODEL WITH PREFERENCE: ENGLISH SUBJECTS

become more favoured. The experiment on color preference was now repeated with all the subject groups in question. The subject was given a series of color plates, the colors ranging from saturated to pastel colors, one plate having only sombre colors, and he was asked to arrange them in order of his preference. As can be seen in Figure 3, the results were in both countries as expected: Children like strongly saturated colors and dislike sombre colors. They are indifferent to pastel colors. With education, people begin to like pastel colors and to dislike strong ones.

The main test used by the writer in studying color or form reaction is a modification of Descouedres' test (1), but varying the colors from pastel and sombre colors to the gaudy ones, so allowing the display of emotions towards the colors used. There are six color plates altogether. On the

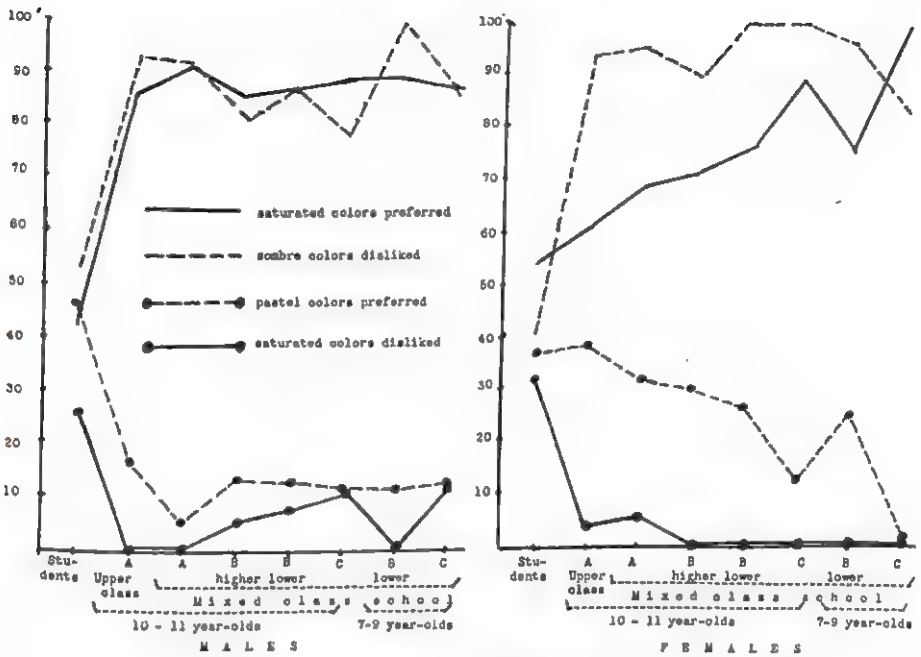


FIGURE 3A
PREFERRED AND DISLIKED COLORS: ENGLISH SUBJECTS

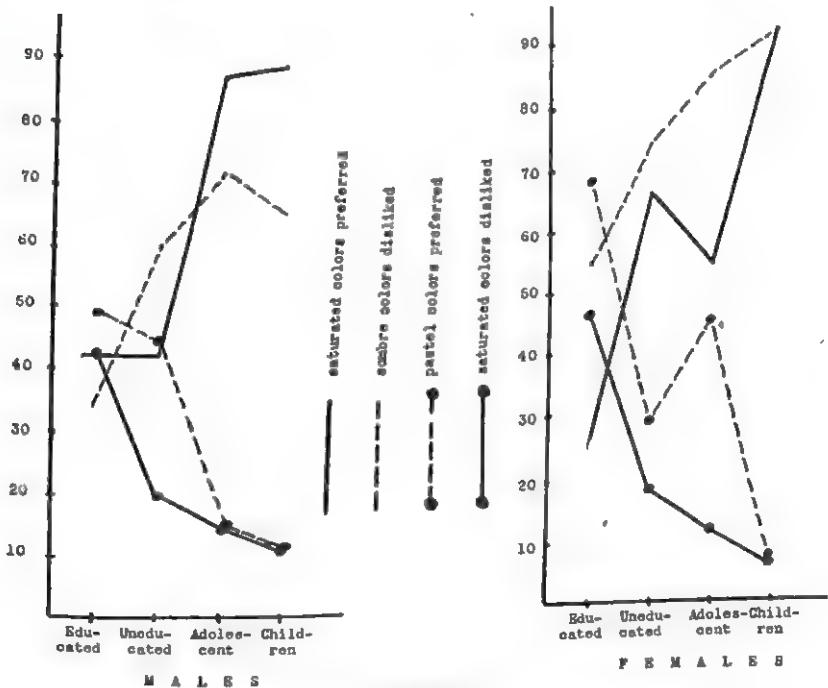


FIGURE 3B
PREFERRED AND DISLIKED COLORS: FINNISH SUBJECTS

first plate, four irrelevant figures of glazed paper are added to gather the haphazard answers of undeveloped subjects. (It works!) The other figures on the first plate and on the two following ones are in pastel colors;

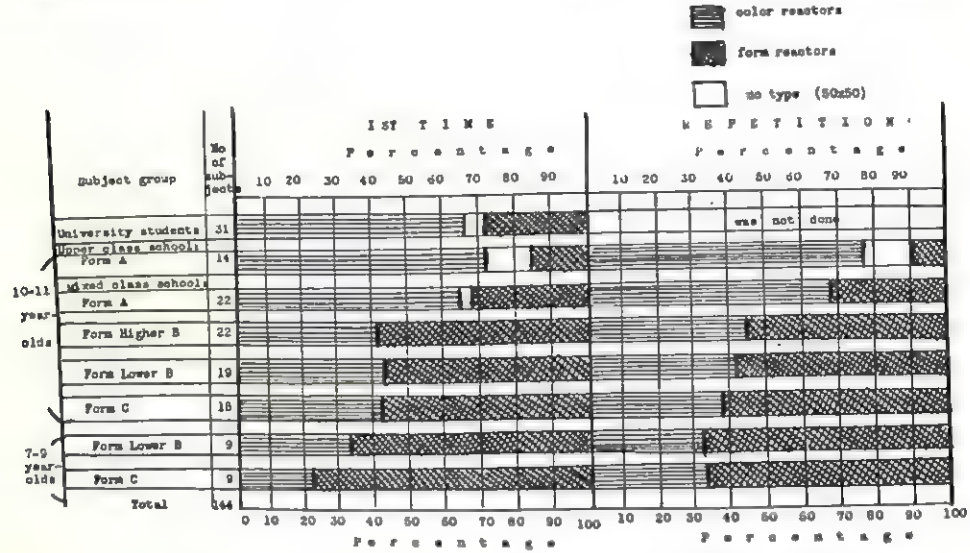


FIGURE 4A
DISTRIBUTION OF COLOR AND FORM REACTORS IN DIFFERENT INTELLIGENCE GROUPS IN ENGLAND: DESCOEUDRES' MODEL (MALES)

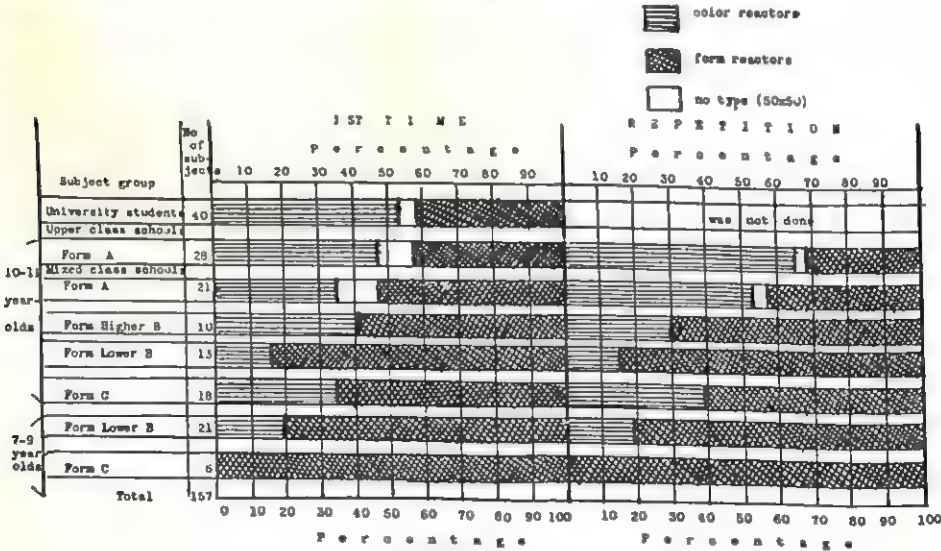


FIGURE 4B
DISTRIBUTION OF COLOR AND FORM REACTORS IN DIFFERENT INTELLIGENCE GROUPS IN ENGLAND: DESCOEUDRES' MODEL (FEMALES)

the fourth plate is in sombre colors, and the fifth and sixth plates in strongly saturated colors. The instructions and the procedure are the same as Descoeudres used: "Place this thing (the model) on the thing there (on a

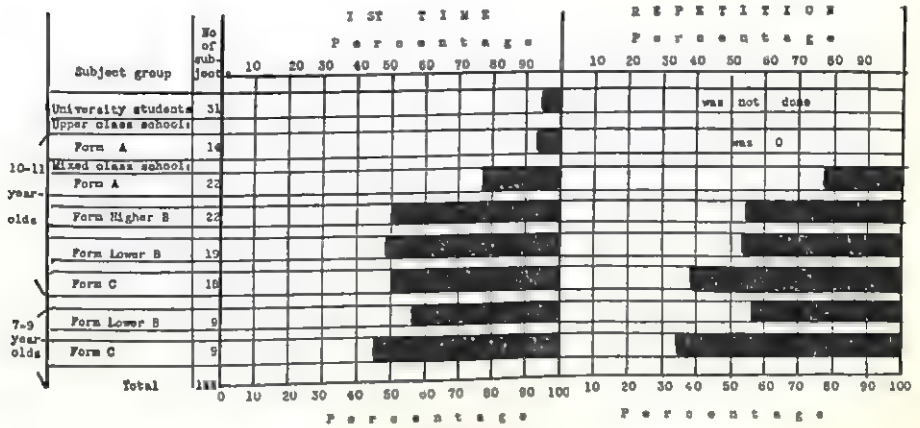


FIGURE 5A
DISTRIBUTION OF PURE FORM REACTORS IN DIFFERENT INTELLIGENCE GROUPS IN ENGLAND: DESCOEUDRES' MODEL (MALES)

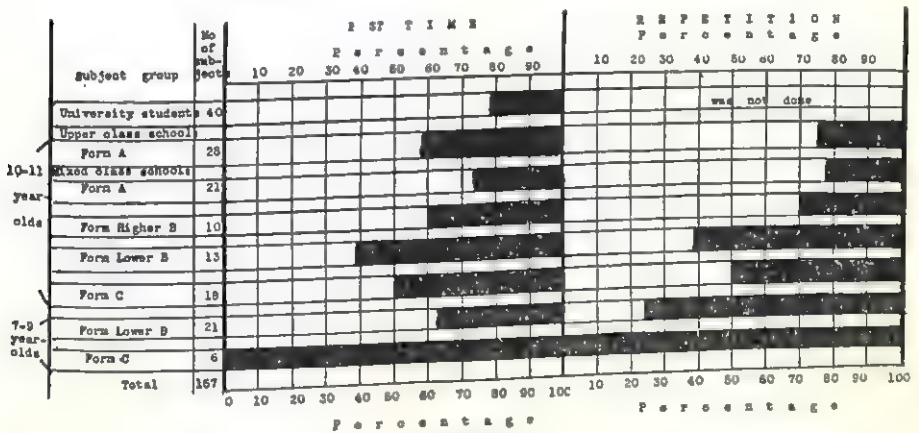


FIGURE 5B
DISTRIBUTION OF PURE FORM REACTORS IN DIFFERENT INTELLIGENCE GROUPS IN ENGLAND: DESCOEUDRES' MODEL (FEMALES)

plate) which is most similar to it in your immediate quick reaction." After some other experiments the procedure was repeated.

If the subject gives only form responses both times (28+28 answers), he is said to be *pure form reactor*. If more than half of his answers are both times form reactions, he is called a *mixed form reactor*. The corre-

sponding grouping has been done with color reactions. Most subjects can be placed either into the group of the color reactors or into that of the form reactors. Only very few people have been so half way that it has been impossible to place them in either of these groups.

4. The Results

a. Connection with intelligence. Figure 4 (*A* and *B*) gives the percentages of color and form reactors in different intelligence groups, when the modified Descoeudres' test was used. The increase in the number of form

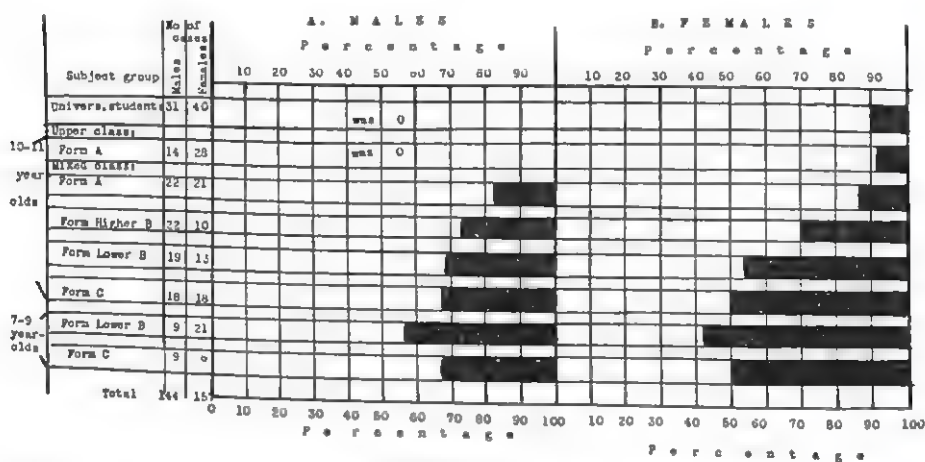


FIGURE 6
DISTRIBUTION OF SUBJECTS WHO WERE PURE FORM REACTORS IN BOTH COLOR AND FORM TESTS IN ENGLAND: DESCOEUDRES' AND KATZ' MODELS
(MALES AND FEMALES)

reactors with decreasing intelligence happens in both sexes, and the tendency remains the same when the experiment is repeated.

The percentages of pure form reactors is also connected with intelligence, as can be seen in Figure 5 (*A* and *B*). Figure 6 (*A* and *B*) gives the percentages of subjects who reacted only to the forms in both of the tests (Katz' model and Descoeudres' model).

To avoid misunderstanding, the writer would like to point out that if a person reacts to form, it is not a sign of low intelligence, but the possibility to find form reactors, and especially pure form reactors, is greater among subjects with low intelligence than among subjects with high intelligence.

b. Sex differences. Females are more often form reactors than men, as can be seen in Figure 7. In the test with Descoeudres' model, the percentage of form reactors was greater in every subject group in England, and

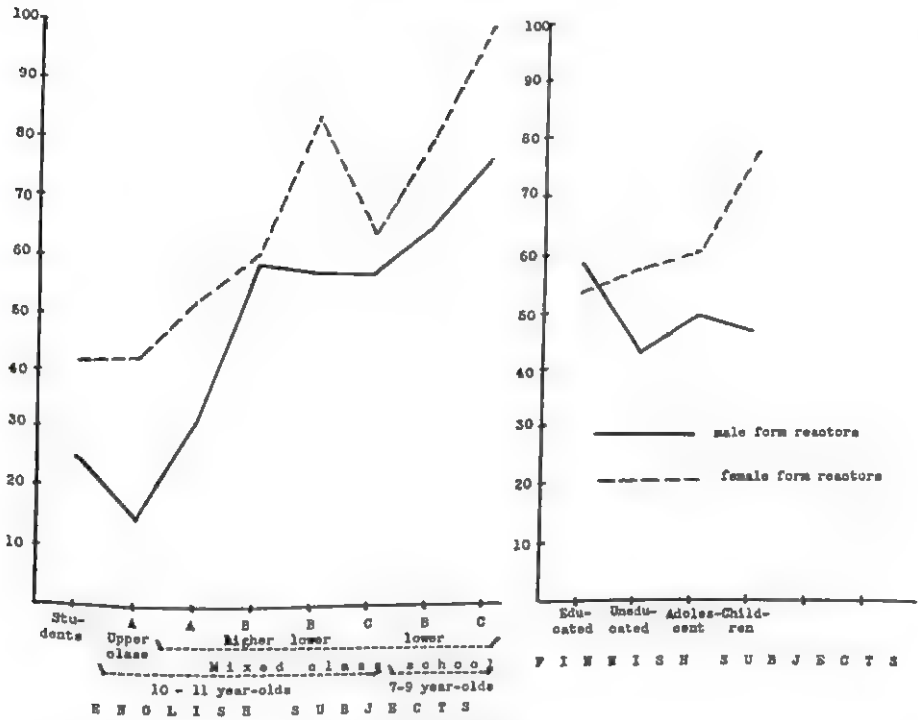


FIGURE 7A

THE PERCENTAGE OF MALE AND FEMALE FORM REACTORS IN DESCOEUDRES' MODEL

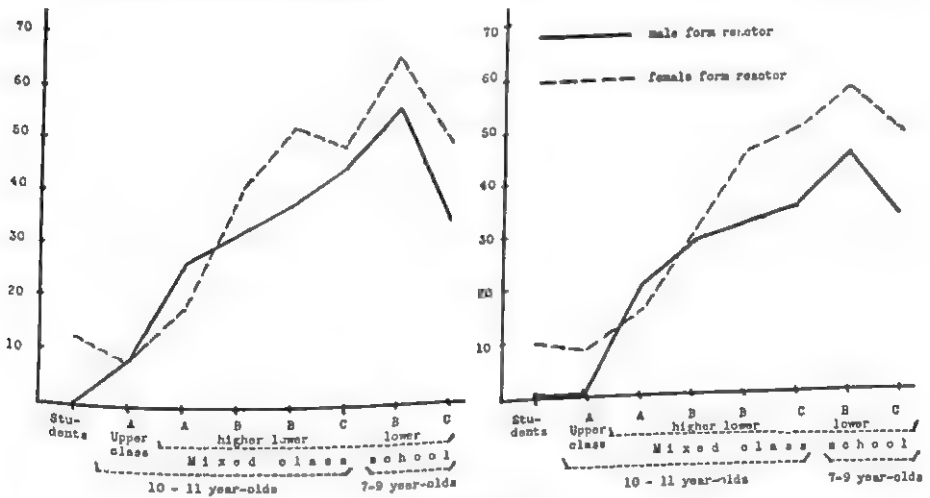


FIGURE 7B

On the left the percentages of male and female pure form reactors in Katz' model with preference; and on the right the percentages of male and female subjects who reacted only to forms in both color and form tests: Descoeudres' and Katz' (English subjects).

the relationship was slightly reversed only in one subject group in Finland. In the experiment with Katz' model in England, only in Form *A* in the mixed social class school the boys were more often form reactors than the girls. The tendency remains the same if only the cases which showed pure form responses in both of the tests (Katz and Descocudres) are taken into account.

C. COLOR AND FORM REACTION AS A BASIS OF A NEW TYPOLOGY

The objection has often been raised, pointing to the low correlation which Keehn (4) found between different color or form tests, that it is impossible



FIGURE 8
FORM REACTOR

to be certain whether a person is really a color reactor or a form reactor, and that the same person who in the present tests has reacted to forms may change over to a color reaction in another test. The writer would like to emphasize that color reaction and form reaction are dimensional phenomena, and a correlation between different tests has very little theoretical value. One person may be so deep in the form dimension that he gives only form answers, whatever one places in front of him, but some other person may be approaching the color pole, and therefore switches over to a color reaction in other tests in which the value of the color is heightened, as happened for instance in the test with preference.

And even if it were impossible to determine whether a person is a color or a form reactor in an absolute sense of the word, this statement would have very little power against the present research, because the color and

the form reaction, as they appear in the tests used by the writer, seem to be connected with the structure of the whole personality, and it looks that a new typology can be built on it. The distinction of color and form reactors may be the same to which psychologists have referred when speaking about Martha and Mary types (the two sisters in Bible) in psychology, but they have not had any test at their disposal with which to measure the difference. The results of the study on personality features connected with the color and form reaction will be published later on, here only two pairs of photographs are enclosed to show the difference in the appearance of extreme form reactors and extreme color reactors. These people are Finnish,



FIGURE 9
COLOR REACTOR

but the difference in appearance between color and form reactors seems to be the same in England and also in America. The girls are a Finnish farmer's daughters and their names are Martha and Mary in reality (Figures 8-10).

D. SUMMARY

With an intent to disprove the inferences drawn by Descoeudres, Katz, etc., that a color reaction is a sign of primitivity in a personality and characteristic of children, the writer has repeated Katz' and Descoeudres' tests, but varying them in liked, indifferent, and disliked colors, so allowing the display of the emotions towards the colors used. The results were quite opposite to the generally accepted theories: Backward children are more often form reactors than bright children, and form reactors are more common

among women than among men. Color and form reactions seem to be manifestations of the whole personality, and a new typology can be built on them. These results will be published later on. Rorschach's statement that a color reaction is a sign of unbalanced emotionality will also be questioned in some further discussion.



FIGURE 10
FORM REACTOR (MARTHA) ON THE LEFT, COLOR REACTOR (MARY) ON THE RIGHT

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AN ATTEMPT TO MEASURE INTELLIGENCE IN TERMS OF ORGANIC DEVELOPMENT*

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A. INTRODUCTION

The ability of a child to do well in the standardized intelligence tests being greatly based on his learning and on the surroundings where he is brought up, the writer has during several years been looking for tests which measure intelligence in the terms of organic development, eliminating the rôle of school learning and the influence of the surroundings, so that the results in different countries will be directly comparable. The basic assumption of the writer, on which the experiments are based, is that a mental development is a branching-out process, and that it is possible to find tests which measure what branches a person has reached in each stage of his mental development. A growing tree is a symbol of mental life, and here an attempt to explain intelligence in terms of this kind of branching-out process will be reported.

There are three branches or modes we are dealing with in this experiment: (a) dynamic-affective behavior, (b) concrete behavior, and (c) abstract or conceptual behavior. Dr. Werner has given a description of dynamic-affective behavior (3). The difference between concrete and abstract behavior has been explained by Goldstein and Sheerer (1). The writer supposes that these terms are so well known to all psychologists that they do not need any further explanation. The writer's purpose was to find a test which measures, besides dynamic-affective behavior, also concrete and abstract thinking, and to show with this test how bright children differ from retarded ones.

B. PROCEDURE AND RESULTS

1. *Subjects*

The experiment was conducted in the Highgate Primary School in London with the same subject groups as those used in the experiment on animism (2).

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¹In conducting the experiment reported in this paper the author has been financially supported by Alfr. Kordelin's Foundation in Finland.

Two groups of children were used, bright and backward ones, the division being based on group intelligence tests and school success. The numbers of subjects at each age level are given in Table 1.

TABLE 1
THE SUBJECTS USED IN THE GROUPING TASK OF OBJECTS

Age	Bright children			Backward children			Total
	Boys	Girls	Total	Boys	Girls	Total	
8-year-olds	8	6	14	8	6	14	28
7-year-olds	8	9	17	9	9	18	35
6-year-olds	8	7	15	9	9	18	33
5-year-olds	7	8	15	10	8	18	33
Total	31	30	61	36	33	68	129

2. Test

The test contained four variations from a grouping task. In the *first variation*, different kinds of buttons, artificial diamonds, a sewing set, and small toys were placed in front of the child and he was asked: "Which of these things do you like best?" When the child had named some of the objects, the experimenter said, pointing to the buttons in the group: "What are these things called?" The child answered: "Buttons." But if it happened that he did not find the word, the experimenter helped him by saying: "They are buttons, aren't they?" After that the experimenter took from a small bag a different kind of button (but matching some of the buttons in the group in color, shape, or size), and asked: "What is this thing here?" The child answered: "A button," but if he was unable to answer, the experimenter again helped him by saying: "It is a button, isn't it?" (It was the experimenter's aim to give the child a hint for completing the task which followed on an abstract level; the cue was thus given to him, but as we can see later on, only the bright children were able to grasp it.) The experimenter then placed the model button in a distant place on the table and said: "I place this thing (the model button) over here. Take from these other things all the ones you think belong in the same group as this model. Take all you think belong together with this model here." Some children immediately picked up all the buttons and placed them with the model button. The experimenter asked: "Why did you do this? What are they all?" If the child answered: "They are all buttons," this was regarded as a sign of *abstract behavior* and scored as such. Also scored as abstract behavior were cases when the child grouped the sewing set (i.e., scissors, two spools of thread, needles) with the model button saying they

were all for sewing. Only bright children showed this reaction. In their answers, some children picked up buttons, toys, and objects in the sewing set which were partly or altogether of the same color or of the same shape or size as the model button, and when asked for an explanation, they explained that the visible qualities of the objects were the same. This kind of answer was scored as *concrete behavior*. Children who showed *dynamic-affective* behavior immediately placed some of their favorite toys, gaudy buttons, or artificial diamonds with the model button and explained that they did so because they liked these objects.

When the child had completed the grouping he was asked: "Can you do it in some other way?" If the child refused to continue, the experimenter said: "Now I'll do it and you tell me whether it is right or wrong." Then the experimenter made all the groupings (the buttons, all objects of the same color, shape, or form as the model, the gaudy objects) the child had not yet done, and the child had to say whether the grouping was right or wrong and for what reason. In the table of results the spontaneous answers of the children and the cases where they accepted the grouping made by the experimenter are combined. The results were the same in both cases.

The procedure was repeated in four variations. In the *second variation*, besides buttons, a ring and dress decorations were placed on the table, and a simple brown button served as a model. In the *third variation*, however, the model button was a gaudy and decorated one, and in the main group all buttons were plain and simple ones. If the child refused to do the grouping at all, saying that none of the other buttons was like the model button, this was scored as a concrete answer, as the refusal was based on the absence of the visible similarities of the objects. In the *fourth variation*, the experimenter placed a group of buttons on the table, some of them being simple and some decorated. Then she took a match box and said to the child: "Look what I have here. I open the box and take from it, what?" She took a small button from the box, and the child answered: "A button." The experimenter then took two safety pins and a hair pin from the match box and placed them, as well as the match box, among the objects to be grouped. If the child grouped the match box or the pins with the model button on the ground that they had all been inside the box, this was scored as concrete behavior.

3. Results

Table 2 gives the answers in each subject group, the scores of each child being shown. The main interest here is the phenomenon of how bright and backward children differ from each other at each age level. Among

TABLE 2
THE SCORES OF EACH CHILD IN THE GROUPING TASK OF OBJECTS

No. of the individual child	8-year-olds			7-year-olds			6-year-olds			5-year-olds		
	Abstract	Concrete	Affective	Abstract	Concrete	Affective	Abstract	Concrete	Affective	Abstract	Concrete	Affective
<i>Bright:</i>												
1	4			4			4			4		
2	4			4			4			4		4
3	5			4			2				7	
4	4			4			4				4	
5	4			4			3				3	
6	4			4			4				4	
7	4			4			4				5	
8	4			4			2				4	
9	2	4		3	4		4				4	
10	2	1		4	3			4			5	
11	2	4			3			4			4	
12		4			1			4			4	
13		4			4			4			5	
14		3			3			5			4	
15					3			4			3	3
16					4							
17					4							
Totals	39		0			0			0	8		7
<i>Backward:</i>												
1	4			5			4			4		8
2	4			4			4	3		3	1	
3		4		2	2		4	2			4	
4		3			3		4		2		4	
5		4			4		4		5		5	
6		3			4		3		2		4	
7		4			5			4			4	
8		4			3			4			5	
9		4			4			5			1	4
10		4			4			2	1		4	2
11		4			4			3	2		3	4
12		3	1		4			4	2		3	1
13		4	3		3			4	1		3	5
14			2		2	2		1	2			4
15					2	1		2	2			4
16					4	1		3	1			3
17						2		2	1			9
18						2			4			6
Totals	8		6			8			25	7		50

the group of 8-year-old children, backward children with two exceptions, are able to do the task only on the concrete level, whereas the large majority of bright children grasped the meaning of the abstract behavior and grouped the other buttons with the model button on this ground. At this age level, only three backward children show signs of dynamic-affective behavior. But when we follow the chronological age down to the young children, we notice how the number of dynamic-affective answers increase and the number of abstract answers decrease. At the 5-year-old level, even the bright children are incapable of abstract behavior, both bright and backward children do grouping on a concrete level, but the difference between the bright children and the backward ones now consists in the fact that backward children show dynamic-affective behavior, beside the concrete grouping, whereas the bright children do not.

C. SUMMARY AND DISCUSSION

We started with an assumption that it is possible to measure intelligence in terms of organic development, and a special grouping test was used with subjects of bright and backward children, the age ranging from 5 to 8 years. The results showed that the difference between bright and backward children consists in the fact that in the oldest group the bright ones are able to do the grouping on the abstract level, whereas the dull ones do it mainly on the concrete level. Going down in the chronological age, the number of dynamic-affective answers increases in the backward group, and in the group of five-year-old children, neither the bright nor the backward group can do the task on the abstract level, both groups are concrete, but the backward group shows dynamic-affective reactions besides.

The purpose of the above discussion has been to give an example of the branching-out process in the development of intelligence, but it also leads us to a question: What does backwardness mean? Does it mean that backward children are more heavily laden with the dynamic-affective element than are bright children who are able to perform only the same limited actual performance? The results in the experiment on animism (2) pointed to the same direction. There also the backward children more often showed dynamic-affective behavior than the bright ones.

If in the further studies the dynamic-affective behavior proves to be one characteristic of backwardness, then we shall possibly be able to predict that a five-year-old child who does not show any dynamic-affective reactions is not backward even when his actual performance is yet limited, as limited

as that of a backward child, but who moreover shows dynamic-affective reactions.

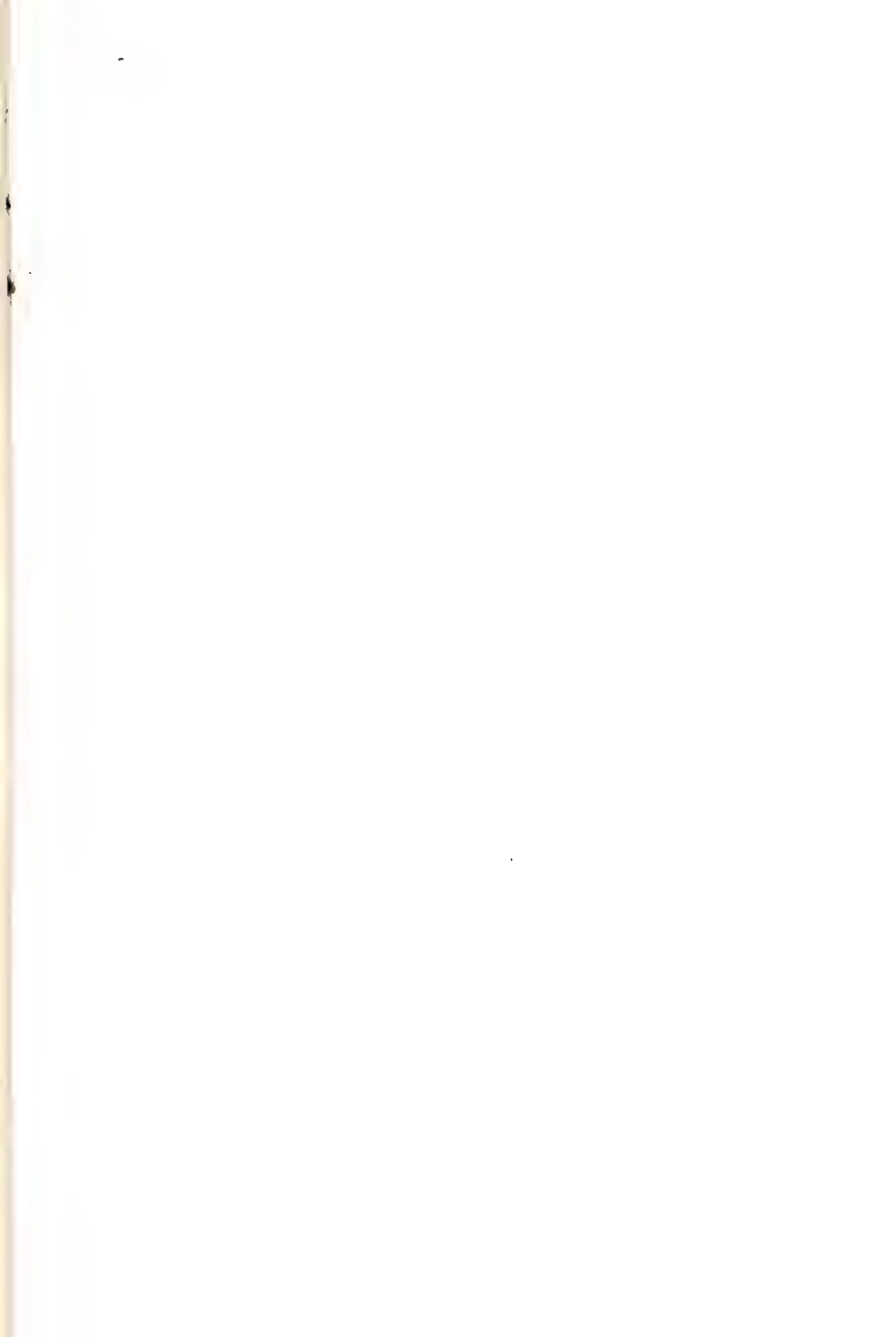
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Nurses' Home

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SOME CRITICAL NOTES CONCERNING THE CONCEPT OF RIGIDITY AND ITS MEASUREMENT*

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A. DISCUSSION

Despite the fact that one kind or another proof of validity is usually required of each new test in psychological measurement, there are still tests, developed by some famous psychologists, which most likely in the shadow of their fame have escaped criticism. One of these tests is *p*-test on perseveration, most recently standardized by Cattell (2). As this test proves an interesting example of how an overt similarity of phenomena can be wrongly interpreted as a similarity in their essence, it may be to the point to clarify the underlying concepts in this field.

There are two concepts which have been mixed with each other in this field, and they are "perseveration" and "rigidity." Perseveration means a mental inertia in switching over from one kind of repeated activity, e.g., writing capital *W*'s, to a new activity, i.e., writing capital *W*'s backwards. The *p*-test we are referring to contains a series of variations on the same principle. This phenomenon of perseveration is shown to be independent of intelligence, and depending on racial differences. But what is wrong in this discussion is that this phenomenon of perseveration is identified with rigidity. Cattell says: "Only assured manifestation of perseveration is a disposition rigidity" (1, p. 436).

What the writer wants to maintain is that perseveration, as *p*-test and other similar tests measure it, is connected with emotionality and is an altogether different phenomenon than dispositional rigidity. There are not any tests, so far as the writer knows, which measure the disposition rigidity.

Cattell himself has mentioned that perseveration is connected with emotionality. The writer correlated the scores in *p*-test with the scores in Pintner's test on emotionality (*Aspects of Personality*) in an experiment with 10-11-year-old school children in London. The correlation coefficients as well as the number of subjects are given in Table 1. The procedure was

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slightly changed from the usual one, so that no preliminary practice was allowed, and the time at each sub-test was lengthened (from 15) to 20 seconds. The connection between emotionality and perseveration is obvious.

But perseveration, i.e., the mental inertia in switching over from one repeated activity to another, is quite a different phenomenon from the disposition rigidity. In *p*-test the action does not contain so much breaking

TABLE 1
THE CORRELATION COEFFICIENTS (RANK CORRELATION) BETWEEN PERSEVERATION
(*P*-TEST) AND EMOTIONALITY (PINTNER: ASPECTS OF PERSONALITY)

Name of the school in London	Age	Form	Sex	No. of Subjects	Coeffi- cient	Signifi- cance
						Fisher
Hampstead Garden Suburb	10-11 years	C	Girls	17	.41	$P = .10$
Hampstead Garden Suburb	10-11 years	A	Boys	25	.42	.05
Hampstead Garden Suburb	10-11 years	A	Girls	11	.35	—
Highgate Primary School	10-11 years	A	Boys	14	.74	.01
Highgate Primary School	10-11 years	A	Girls	14	.71	.01
			Total	81		

of an old habit as *starting an altogether new series of action after the previous (habitual) action*. For instance, if a person writes first capital *W*'s for 15 seconds and then starts writing them in the opposite direction, the nature of this change is that an action *A* (writing *W*'s) is followed by another action *B* (writing *W*'s backwards), which is quite different from the first one. The actions *A* and *B* have *no element in common*, and the procedure can be marked symbolically $A \rightarrow B$. The disposition rigidity, as contrasted with perseveration, always means that *something in the series of action or in the field remains the same*, and that *the person experiences the change of a detail as disturbing*. Werner (4) gives a good description of disposition rigidity, and it is amazing that personality psychologists have paid so little attention to him. In the behavior of a rigid person, one part of the whole event follows its predecessor as a matter of necessity, for none of the parts has in itself any kind of independence. A rigid behavior is a reaction which must run its particular course as an unbroken whole, and even a small change of a detail causes the whole action to be disturbed.

The writer has closely watched patients with sclerosis, and their behavior offers a good example of rigidity. For example when a patient is undressed, it must always occur in a certain order, first the vest, then the

shoes, then the shirt, then the socks. If one changes the order, for instance by taking the socks before the shirt, the patient shows an outbreak of temper. Here thus a series of actions $A \rightarrow B \rightarrow C \rightarrow D$ must be repeated exactly in the same way, and even a small change $A \rightarrow B \rightarrow D \rightarrow C$ is experienced as a change of the whole action. In the same way, a small change in the environment changes the whole environment and causes chaos in a rigid mind. The patient cannot eat his meal, if the drinking glass is not in exactly the same place every time, etc. A female patient lost her mental balance, when a new piece of furniture, a cupboard, was placed in her room while she was sleeping, and she never recovered from the shock. With frightened eyes, her face expressing the feeling of helplessness and confusion, she lay on her bed, staring at the cupboard, which had changed the whole room so that she could not recognize it any more, and died. We may be right in saying that in this case a cupboard killed a woman.

Perseveration is independent of intelligence, but as Werner and Lewin (3) have already illustrated, the disposition rigidity is one of the characteristics of mentally retarded or feeble-minded individuals, and *any test of rigidity which does not show any connection with intelligence, is not any measure of rigidity at all*. One sign of validity of a rigidity test must thus be the connection with intelligence. If you watch the change in the behavior of patients with sclerosis, you cannot miss a degradation in their whole personality: emotional life becomes frozen, the patient does not feel any affection towards anyone, and the expressionless face is more that of a troll than of a human being.

B. SUMMARY

The purpose of this paper was to make clear the difference between perseveration and disposition rigidity. Perseveration, i.e., a mental inertia in switching over from a series of repeated actions to a new series of actions, seems to be connected with emotionality, and most likely also with the depth of the personality. Disposition rigidity, on the other hand, means that something in the series of actions or in the environment remains the same, and that the change of a detail is experienced as a change of the whole and is disturbing. The writer does not know any test which measures this real dispositional rigidity. In order to find a test which measures it, one ought to start with subjects who in real life show rigid behavior, and then show how their answers differ from those of normal persons. Being misled by the overt similarity of the phenomena, the discussion in this field has until now neglected this point of validity which ought to be of crucial importance.

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Nurses' Home

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NUTRITIONAL DEFICIENCIES AND EMOTIONAL DISTURBANCES*

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That the nutritional status of an individual may affect his psychological well-being appears to be demonstrated by experimental evidence which has accumulated during the past two decades. This paper is concerned with clinical and experimental findings in medicine, nutrition, physiology, and biochemistry regarding the effect of nutritional deficiency upon personality. Research in these sciences has also contributed to greater understanding of nutrition's rôle in other areas important to psychologists. In numerous studies the influence of the nutritional level upon stress, gerontism, work efficiency, and mental health, for example, has been indicated. This relationship between nutrition and psychology is but one aspect of the somatopsychic approach currently receiving increased attention from psychologists.

Emphasis upon the interdependence between the individual's nutritional status and his psychological reactions, the psychonutritional relationship, is illustrated in a discussion by Campbell of the University of California (24). He recognizes the nervous system as being more sensitive to nutritional variance than any other part of the body. Campbell, among others, emphasizes the essential rôle of *B*-complex vitamins in carbohydrate metabolism which furnishes energy for nerve functioning. He points out that minerals are required by nerve tissue not only for its respiratory functions, but also to maintain the electrolyte balance in its fluid media. The Gilman (50) stress that since the brain and spinal cord are dependent for their nutrition on many other organs and tissues, it follows that if any is malfunctioning, the nervous system cannot escape injury. They call attention to the well-known fact that a complex protein, lipoid, sugar, and mineral metabolism is needed for the construction of the nerve axis cylinders and other structures which constitute the neurons.

The dominant interest may at first appear to be mainly in vitamin research, partly because vitamins more directly and immediately affect the nervous system than do other nutriment, and partly because they yield

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more readily to experimentation. Those who have made the investigations emphasize, however, that other therapeutic nutritional factors are involved. This pre-eminence of the vitamins should be interpreted as indicating the need for more research in other areas of nutrition.

Peterman and Goodhart (101) have summarized the status of vitamin therapy in nervous and mental diseases. They conclude the importance of energy production to the nervous system's functioning plus the significance of the metabolic rôles played by the vitamins, provide an explanation for the occurrence of such symptoms as those listed in Tables 1 and 2. The experi-

TABLE 1
VITAMIN DEFICIENCIES AND THEIR NERVOUS SYSTEM SYMPTOMS

Vitamin	Clinical reports
Thiamin	Anorexia, constipation, forgetfulness, difficulty in orderly thinking, ideas of persecution, headache, insomnia, vertigo, burning sensations, cramping, muscle tenderness, excessive salivation.
Riboflavin	Apathy, indifference, inability to adjust to tasks such as school work.
Niacin (Niacinimide)	Depression, apprehension, increased irritability, insomnia, headaches, dizziness, muscular weakness and symptom complexes characteristic of neurasthenia, anxiety states and other neuroses. In advanced deficiency, memory loss, excitement, mania, delirium, hallucinations, dementia, tremor, jerky movements frequently accompany the mental symptoms.
Pantothenic Acid	Nutritional melalgia (burning feet). Administration of large doses, prior to cold stress, prevents certain metabolic changes which may have an indirect effect upon the nervous system.
Pyridoxine	Epileptiform convulsions, weakness, insomnia, irritability and difficulty in walking. Some reports of reduction in number and severity of seizures in certain patients with epilepsy. Reported to produce additional improvement in certain pellagrins after maximal effect from niacin, riboflavin, and thiamin.
Cyanocobalamin (B ₁₂)	The secondary mental effects of pernicious anemia that may occur probably caused by the anoxia: dullness, headache, depression, apathy and drowsiness or excitement and loss of self-control.
Biotin	Mental symptoms characterized by a confused, depressed state with hallucinations and anorexia (experimental work has not been repeated).
Pteroylglutamic Acid (Folic Acid)	Mental depression, loss of sense of well-being.
Ascorbic Acid (C)	Lack of energy, fleeting pains in joints and limbs, irritability, lack of stamina; emotional instability (crying, inability to adjust as in an experimental situation), longer reaction time, more stereotyped responses in infants.

Note—Adapted from Peterman, R. A., & Goodhart, R. S. (101), by permission of publisher.

mental work represented by these tables derives from the deliberate creation of single deficiency states in humans and animals, and from the treatment of multiple deficiency conditions in malnourished individuals. In these experiments the vitamins have often been tested separately, but it is the consensus that a diet so inadequate as to produce a deficiency of one vitamin is generally lacking in others. The *B* vitamins in addition have been found to work synergistically.

TABLE 2
PHYSICAL FINDINGS AND SIGNS ASSOCIATED WITH VITAMIN AND NUTRITIONAL DEFICIENCIES AND IMBALANCES

Site	Finding
Hair	Dry, staring, alopecia.
Scalp	Seborrheic dermatitis (common form characterized by brownish-grey scales or scabs).
Lips and mouth angles	Rhagades (clefts, chaps, or excoriations in the skin), cheilosis (cracking at corners of mouth), increased fissuring of lips, perleche (thickening and scaling of skin at corners of mouth—sometimes smarting fissures).
Buccal mucosa	Inflammation.
membranes	
Eyes	Thickened conjunctiva, vascularization of cornea, Bitot's spots, blepharitis (inflammation of lids).
Tongue	Edema, fissuring, prominence or atrophy of papillae, color changes.
Gums	Blunted papillae, inflammation, edema, recession, atrophy.
Skin	Dryness, crinkling, follicular hyperkeratosis, dyssebacea (malfunctioning of the secretion of skin glands), ichthyosis (dryness, roughness, scaliness).
Neurologic	Plantar dyesthesia, diminution in vibratory sense, diminished to absent tendon reflexes.

Note—These signs are not always pathognomic of vitamin deficiencies, but are suggestive and may represent actual deficiency. When detected in their earliest stages, they are completely reversible.

Adapted from Peterman, R. A., & Goodhart, R. S. (101), by permission of publisher.

An early representative study of the effect of thiamin, B_1 , deficiency was initiated in 1938 by Wilder (169) and conducted by his colleagues at the Mayo Clinic (170). Their subjects were four young "recovered" women from a hospital for psychopathic patients who were maintained for 147 days on a basal diet containing 0.075 mg. thiamin per thousand calories. They served as their own controls. A similar study of four more patients and two controls followed (171). The individuals of both groups developed behavioral changes in from 10 days to five weeks. While no psychological tests were used, the signs of psychopathology were evident. They were retested in "attitude, behavior, and effectiveness in performing tasks which

previously had been performed readily." There was inability to concentrate, confusion of thought, uncertainty of memory, and weakness. "All subjects became irritable, depressed, quarrelsome, uncoöperative, and without knowing why, fearful that some misfortune awaited them. Two became agitated, felt that life no longer was worth living and threatened suicide." All lost manual dexterity, complained of headache, painful menstruation, insomnia, and sensitivity to noise. "The early stage of the disease induced by restricting the intake of B₁ closely resembles neurasthenia; the latter simulates anorexia nervosa."

Since these two studies involved a more severe restriction of thiamin than is usually found in American diets, a further experiment was undertaken in 1940 with 11 women from the same institution (172). They were placed on what would for many be a typical American diet containing 0.45 mg. thiamin. Again the subjects served as their own controls and were unaware of the nature of the study. There was also a simultaneous and parallel experiment in which riboflavin was deficient. Only in the thiamin-deficient subjects did the abnormalities considered to be associated with B₁ deficiency, and noted in the two previous studies, occur. They improved when thiamin was the only addition to their diet. In this instance the personality changes were somewhat delayed, occurring after eight to 12 weeks and in the more active subjects first. These three studies have sometimes been criticized because they were conducted with "recovered" patients. Jolliffe and his colleagues at Bellevue Hospital (76), however, reported similar results just prior to these studies. Four of the five physician-subjects they placed on a diet 38 per cent deficient in thiamin developed neurasthenic syndromes in four to 30 days.

Horwitt and other members of the staff at Elgin State Hospital, in Illinois, conducted an extensive thiamin study from 1943 to 1946 (68). They restricted the intake of five young and seven aged male patients to 0.4 mg. of thiamin and 0.8 mg. of riboflavin per day. Three psychological tests were given at monthly intervals. The decline observed was hard to quantify psychologically since it was very gradual, but the attention span, interest, ambition, playfulness, sociability, speed, and manual dexterity were definitely affected. The thiamin was further reduced to 0.2 mg. per day. Then the decline in test response was more rapid and marked in the aged men and in one of the young men, though all scores deteriorated. The subjects appeared to exert compensatory effort during the tests, but afterward would relapse into their more customary apathy. The parallel experiments on the riboflavin deficiencies did not produce the mental changes that thiamin deprivation did.

At the University of Minnesota's Laboratory of Physiological Hygiene, Keys and his co-workers (23, 80, 81) began a series of investigations in 1941 on the effects of restricted *B*-complex on four normal young men with four controls. This was part of their interdisciplinary research program in human biology (22) that has made the center well-known for its contribution to the somatopsychic concept. The diet was partially restricted in B_1 , B_2 , and niacin for 161 days. There followed a 23-day period in which these vitamins were severely restricted. They found that self-ratings and man-by-man ratings gave no evidence of change in the sense of well-being and adjustment during the partial restriction, but indicated a consistent and striking deterioration during the acute deficiency. Similarly on the Minnesota Multiphasic Personality Inventory significant changes in depression, hysteria, and hypochondriasis occurred only during the acute period. Slight deterioration on the Rorschach was indicated in three of the four experimental subjects at the end of the partial restriction period and these changes increased on the acute restrictions. There was loss of spontaneity with an increase in tension. Apparently individuals with "better" personalities were more able to resist the stress of the dietary restrictions. Recovery occurred on thiamin alone.

This apparent primary importance of thiamin led to a subsequent investigation (21) on 10 young men of the effect of partial thiamin deprivation at different levels of intake and of acute deprivation. Inclusive tests of sensory functions, motor and intellectual performance, and personality were given. The methods of this study permitted the observation that the degree of deterioration on the *MMPI* was correlated with the level of supplementation while on the partial restriction diet. The deterioration of the *MMPI* scores in acute deficiency and the improvement during the subsequent supplemental period were significant at the 1 per cent level. The experimenters were impressed with the dramatic speed and degree of recovery when thiamin was reinstated.

A timid and depressed person, according to Spies (140), could be transformed into a pleasant and coöperative individual when 50 mg. of B_1 were administered. All patients in a series of 115 cases on a low thiamin diet with no clinical evidence of beriberi other than emotional disturbance and subclinical signs, thus responded to parenteral B_1 within 30 minutes to 20 hours. He believed the results were similarly successful whether they had neurotic backgrounds or were previously well integrated. Dr. Spies, Chairman of Northwestern's Department of Nutrition and Metabolism, first became interested in the effects of nutritional deficiencies when he realized in

1930 that malnourished persons were "unbelievably weak and listless (129)."

Kugelmass (84) reports that neurasthenia is the functional disorder first observed in thiamin deficiency in children. It is manifested by fatigability, anxiety, irritability, forgetfulness, headaches, impaired judgment, bodily complaints, hypersensitivity, ease of frustration, and sleeplessness. He finds that if there is no irreversible basis for the behavior an adequate dietary reinforced with thiamin improves, even if it does not always cure, the condition. He adds that he is "unable to differentiate this syndrome from psychogenic disorders."

Jolliffe (75), as well as others, noted that the severe types of athiaminosis, such as Wernicke-like syndrome, are not seen so frequently since the advent of "enriched" bread in 1941. In summary it appears that moderate thiamin deficiency can develop into a neurasthenic syndrome similar to that frequently observed in clinical practice.

Niacin, like thiamin, has been demonstrated to be essential in maintaining normal nervous system metabolism. This has been shown notably in its therapeutic effect upon the neurasthenic symptoms associated with pellagra. The history of niacin therapy, however, shows some of the difficulties encountered in attempting to delineate the interactions.

The clinical form of pellagra, since Goldberger's research (52), has been understood sufficiently to treat it fairly successfully. In 1935, at Hillman Hospital in Birmingham, Spies (126) reported the reduction of mortality in severe pellagra from 54 per cent to 6 per cent by giving large doses of brewer's yeast or by administering liver extract parenterally and by simultaneously keeping his patients on diets high in protein, calories, minerals, and vitamins. By 1938, three reports (46, 12, 133) had independently appeared utilizing niacin effectively in the treatment of human pellagra and its associated mental symptoms.

Sydenstricker (148) delineated the progression of pellagrous symptoms from the early subclinical stages characterized by loss of appetite, weakness, failure of mental acuity, nervousness, fatigue, and irritability. These symptoms, however, are common to almost all cases of nutritive failure. He considered that because neurons are more sensitive to disturbances of nutrition and oxygen supply than are any other cells, signs and symptoms referable to the nervous system are particularly common in deficiency states. The mild psychic disorders may precede other manifestations by months. Other mental symptoms that may develop include loss of memory for recent events, insomnia, anxiety, apprehension, distractibility, and mild delusional states. Among the physical symptoms often considered to have psychological impli-

cations that may develop in pellagra are partial deafness, particularly for high tones, digestive disturbances, burning in the esophagus and stomach, and flatulence. Anorexia is prevalent in deficient children, but occurs in all ages. In women there may be concurrent nonspecific vaginitis, usually with hyperesthesia and dyspareunia. Various forms of dermatitis are also an essential part of the picture of subclinical pellagra. It is characteristic that such symptoms undergo spontaneous remission and recurrence, apparently varying with the nutritional status. They may be seasonal or follow infection, fatigue, or trauma.

The effects of niacin deficiency in children have not been as fully reported as in adults. Spies and his staff in 1939 (136) studied 194 pellagrous children. Their parents described them as irritable, easily frightened, fretful, crying a great deal, listless, tiring quickly, apprehensive, lacking in appetite and the normal interests of children. In school they had difficulty concentrating and did not progress satisfactorily. As did adults, they responded to niacin, yeast, and improved diets. Kugelmass (84) has made similar observations.

Many reports of the successful treatment of clinical and subclinical symptoms of pellagra with niacin were made. In 1945, however, Briggs and colleagues (16) were unable to detect any abnormalities in subjects they observed for a period of 42 weeks on an adequate diet restricted only in the amount of niacin. Research has since continued with resulting clarification. It now appears that the amino acid, tryptophane, is converted by the body into niacin (112). Pyridoxine, in addition, has been shown (157) to be a limiting factor in the catabolism of tryptophane. There are indications that still other factors are involved, thiamin being one (53). Serotonin appears to be related to mental functioning (174) and tryptophane is a precursor for it (124). The reason becomes clearer for Spies' observation that specific synthetic chemicals will remit specific deficiency diseases, but the improvement is more striking and permanent with a well-balanced and liberal diet accompanying them (135). Briggs' subjects were probably securing adequate tryptophane and associated factors for the synthesis of niacin during the period of the experiment.

The nutritional deficiency resulting in the clinical form recognized as pellagra with its associated psychopathology has, in most cases, existed for months or years in a subclinical form. In fact, it may never develop into pellagra, and as such is not confined to the South (130). Spies (127) has found that most malnourished patients have some degree of mental disturbance which frequently is the only evidence of altered bodily function pres-

ent relatively early in deficiency states. During these periods of prolonged dietary deficiencies the mental symptoms are susceptible to diagnosis as hysteria, depression, neurasthenia, or anxiety states. McLester (91) gave the illustration of a patient whose diagnosis was typical of the difficulty encountered in classifying subclinical syndromes. The symptoms of this patient fluctuated to such an extent that the diagnosis was variously made as inadequate personality, constitutional inferiority, or neurasthenia. The patient had frequent emotional upsets, displayed little energy, and his work became ineffective. Nicotinic acid with an adequate diet brought immediate improvement.

Evidence regarding the effects of other *B* vitamins upon the clinical aspects of the nervous system's functioning has been less extensively reported. The essential rôle of several in the metabolism of neural tissues has been determined, however, in the laboratories (123). Ralli and associates (105) found that pantothenic acid, another of the *B* vitamins, may assist the adrenals to tolerate cold stress more adequately. Young men on adequate diets were subjected to stress by immersion in cold water for eight minutes and several physiological responses were measured. When supported with pantothenic acid, there did not appear to be as great need for adrenal cortex hormone production. A later experiment (106), however, gave evidence that B_{12} was more effective than the other nutritional factors tested, B_{12} and *B*-complex, in helping them maintain bodily temperature after immersion although none of them significantly increased the recovery rate. Ralli recognized several limitations in these experiments and did not feel that their conflicting evidence discredited the work with animals in which the protective value during stress of vitamin *C* and pantothenic acid has been demonstrated.

Gopalan (55), as reported by Sebrell and Harris (116), found that dried brewer's yeast was the most successful therapeutic agent for the syndrome of "burning feet." This syndrome has been experienced by many men in prisoners-of-war camps and has accompanying mental symptoms. Neither thiamin, riboflavin, nor nicotinic acid was effective therapeutically, but pantothenic acid was. Glusman (51) believes Gopalan's work needs more confirmation. Harrison (61) recognized the syndrome among prisoners in Hong Kong. He attributed the illness to malnutrition and noted the patients were tense, nervous, and easily moved to tears. This latter symptom is mentioned infrequently in the literature, but is often encountered in clinical practice and may be associated with deficiency of the *B*-complex.

The use of analogs to produce deficiencies is a comparatively recent tech-

nique. There is, however, always the question whether they may cause some toxicity. Bean and Hodges (6) induced a pantothenic acid deficiency in four subjects with an analog. They were on the deficient diet for 35 days after a 12-day control period. After the second week the men started complaining of fatigue and the desire to sleep during the day. Anorexia and constipation were symptoms experienced by the third week. The men were quarrelsome, discontented, paresthetic, irascible, and easily upset by the fourth week. They also had the symptom of burning feet. Further experimental work was done with two subjects (90). The results were similar except the mood changes were not so impressive. However, one subject became disoriented and hallucinations developed.

Spies and associates (134, 139) administered pyridoxine, B_6 , in a syndrome that failed to respond fully to B_1 , B_2 , or nicotinic acid. Complaints included extreme nervousness, insomnia, irritability, abdominal pain, weakness, and difficulty in walking. Within four hours after parenteral injections of 50 mg. of pyridoxine the subjects experienced dramatic relief, and within 24 hours the symptoms disappeared. One patient unable to walk more than a few steps walked two miles within 24 hours after injection. This supports their conviction that deficiency diseases are often multiple in nature. Confirmation of these results has come from Hawkins (62) and Vilter (156) who reported depression and mental confusion that responded to B_6 therapy. Vilter, however, produced the pyridoxine deficiency by feeding desoxypyridoxine, an analog, and believes spontaneous deficiencies are rarely found. Hawkins and Barsky had the opportunity to observe one man completely deprived of B_6 for two months who developed a severe depression and mental confusion. Rosenbaum and associates (108) secured relief of muscular weakness and fatigue by using pyridoxine. The symptoms had been vaguely diagnosed in one case as neurasthenia and were associated with various syndromes in seven other cases. They believed pyridoxine only effective when nutrition supported it. Nelson (97) found B_6 administered to patients with macrocytic anemia gave them a sense of well-being.

In 1950 Synderman (150) induced convulsions in an infant and believed them due to lack of pyridoxine. In 1951 and 1953 a mysterious appearance of a convulsive disorder in infants was traced to a proprietary formula that lacked pyridoxine. Coursin (32) noted also increasing hyperirritability and startle response in children with low B_6 intake. Kugelmass (84) reported that pyridoxine relieved in children the symptoms of aesthenia, but it was associated with other deficiencies of the *B*-complex. He described the same symptoms as did Spies.

The difficulties encountered in isolating the effects of individual vitamins are illustrated in the studies of riboflavin, B_2 , deficiency. In 1938 Sebrell and Butler (114) conducted an experiment with a group of patients on a diet low in B_2 and niacin and concluded that the pellagra sine pellagra symptoms were due to and responsive to riboflavin. Vilter, Vilter, and Spies (155) obtained further improvement with B_2 in four pellagrous patients who had relapsed on poor diets supplemented with B_1 and niacin. They ruled out psychotherapeutic possibilities in the environment, as was the usual procedure in clinical studies, by feeding placebos first. There were no changes in symptoms. They then gave them 50 mg. of B_2 for two days. The riboflavin brought them improvement in their sense of well-being and increased vigor as well as improvement in the objective signs.

The next year Spies and his associates (138) reported a study of 241 Alabama children who had been living on diets deficient in B_2 . Many of them were apathetic, indifferent, and were making poor progress in school. Spies used 1 mg. B_2 , 1 oz. brewer's yeast, or liver extract for successful therapy. When neither Boehrer (13), Keys (80), Williams (172), or Horwitt (68), however, could establish changes occurring in individuals on low riboflavin diets, it was believed that the clinical manifestations of B_2 deficiency were indistinguishable from those of B_1 and niacin.

In 1945, Spies (142) again reported successful therapy with B_2 alone in 300 cases in which the ocular symptoms were most prominent. There were early complaints of weakness and fatigability, with nervousness, insomnia, and headaches, as well as the physical symptoms all of which improved with the B_2 . When Horwitt and his colleagues (69) were able to establish evidence of riboflavin depletion in 15 male subjects, they recognized that the previous studies had failed to produce changes because too much riboflavin had been retained in the diet or the experiments terminated too quickly. They kept their subjects on a 2,200-calorie diet containing 0.55 mg. B_2 for nine to 17 months. On the psychological tests they administered there was evidence of mental fatigue in the experimental subjects toward the end of the experiment as measured by flicker fusion tests.

Spies is the only investigator who has indicated specific symptoms of psychopathology associated with B_2 deficiency. Those he has observed are symptoms also associated with the deficiency of other B vitamins. Spies, moreover, has stated that it is impossible to separate the premonitory symptoms of the spontaneous B_2 deficiency from those of B_1 or niacin because they tend to occur as complexities.

Folic acid (pteroylglutamic acid) and cyanocobalamin, B_{12} , are both used

therapeutically in the anemias and appear to have a reciprocal relationship. Anemia may produce psychological disturbances because some degree of anoxia and fatigue often results from it. Headaches, depression, apathy and drowsiness or excitement and loss of self-control may develop, according to Kugelmass (84). The history of folic acid therapy is not without controversy. Ross and his colleagues (26, 109) believe that folic acid therapy must be accompanied with B_{12} and liver extract. They do not consider that it gives an additional sense of well-being when it is included in the therapy for the anemias. Bethel (10) and Spies (128) consider that it does. Bethel recognizes that folic acid apparently utilizes in some way the existing B_{12} in the system and may, therefore, cause a deficiency of cyanocobalamin, but he does not conclude it is toxic. This could explain Conley's (31) finding that pernicious anemia may result from multivitamin therapy, that is, the amount of folic acid in the formula perhaps overbalances the B_{12} . Davidson (35), in discussing anemia therapy, prefers a potent liver extract to purified vitamins of the *B*-complex and refers in particular to folic acid as an imbalancing factor. Spies (143) has reported more satisfactory results with folic acid, but does not recommend it for anemias where there is danger of spinal cord involvement. It may be that his experience with folic acid is better because his therapeutic approach always includes a highly nutritious diet as a base for his supplementation. Biskind (11) considers oral administration of folic acid prevents possible harmful effects.

A pregnant woman with macrocytic anemia complicated by a deep depression with a sense of impending death was relieved of the psychopathology, according to Day (38), within three days after initiating folic acid therapy. Wetzel (164) produced a growth response in five of 11 children with some degree of growth failure by giving them 10 mg. of B_{12} daily. Of interest here is his report that they improved in physical vigor, alertness, general behavior, and school achievement. He repeated the experiment (165) in a school having children from homes with adequate income and secured similar results. In a series of 25 cases of B_{12} deficiency Holmes (67) found 14 with definite cerebral symptoms that responded to a correction of the insufficiency if the condition had not progressed to an irreversible state. The symptoms ranged from slowness of thought and slight mood disorders to dementia.

Only one experiment on biotin deficiency has been reported (149). Four volunteers experienced mild depression after the fifth week of restriction. This progressed to extreme lassitude, somnolence and hallucinations in one subject and mild panic in two as well as physiological symptoms in all. Re-

lief of the symptoms required 150 mcg. daily with the psychopathology responding most quickly. Two patients experienced a mild euphoria on this amount of supplementation.

The methylating factors, choline and betaine which are members of the *B*-complex, and methionine, one of the amino acids, have been found clinically to produce a sense of well-being not directly correlated with the physical recovery (14, 57, 96). Borsook (14) has hypothesized that this result is referable to the effect on the nervous system. Recently the discovery of B_{15} has been reported (82). Clinical observations have indicated it has potentialities because of its methylating powers for the relief of nervous tension, anxiety, confusion, and depression (40) as well as the symptoms of alcoholism (83). Experimental work is necessary to clarify these observations.

There have been several studies of the various effects of deficiencies in the entire *B*-complex. Many of them are primarily concerned with the effect on work efficiency and will not be reviewed here. The first psychologically controlled experiment was conducted by O'Shea, Elson, and Higbe at the University of Pennsylvania in 1942 (99). They maintained four nonpsychotic middle-aged females and four controls on deficient diets for from 62 to 98 days. Psychological tests showed no deterioration in general intelligence scores, reasoning ability, or speed of eye-hand coordination. The subjects' scores on the Porteus Maze, however, decreased, then improved with thiamin or yeast supplementation. The subjects also were reported as confused, less able to reason and to exhibit judgment in the clinical situation. Similar work on *B*-complex restrictions at the University of Minnesota has been referred to under the discussion of thiamin (23).

A subclinical scurvy in children was recognized as early as 1920 by Hess (63). Among the symptoms found in those habitually getting too little *C*, the antiscorbutic vitamin, were a loss of energy, fleeting pains in joints and limbs often mistaken for rheumatism, irritability, and lack of stamina. Scurvy is still present among infants. Dogramace (41) and Spies and Butt (145), for example, emphasize that the subclinical form is more frequent than realized. Infants with this condition are listless, pale, and unhappy. There is no effort to kick and play. Colby and associates (30) reported as an observation incidental to their primary study that *C* deficiency had a deleterious effect in six normal infants. They showed greater emotional instability (crying, irritability, and long and difficult adaptation to the experimental situation). There was also a smaller range of individual differences (more stereotyped responses, retarded head lifting, longer reaction time).

Among the changes Crandon (33) observed during a self-imposed *C* deficiency were only two of psychological significance—weakness and a feeling of fatigue. Ten subjects were limited to 1 mg. of *C* per day for 15 months in a study reported by the Medical Research Council in England (182). They detected no serious psychiatric disorder resulting. There was no evidence of deterioration in attention span. Environmental or psychological stress caused sudden and extremely great decreases in the blood levels of *C* if the individuals had not been fortified with the vitamin, according to Urbach and colleagues (153) in their study of serum levels of various vitamins. In some instances vitamin *E* followed the same pattern, but to a lesser degree. Wortis (176) noted that alcoholics with mental symptoms had a subnormal *C* content in the blood. Berkenau (8) found elderly mentally deteriorated patients were more depleted in *C* than normals.

Physiological investigations of ascorbic acid have indicated its involvement in the metabolism of the nervous system (5). Giroud, according to Gould (56), considers that it protects against possible anaphylaxis when large amounts of the *B* vitamins are given intravenously. Gould includes *C* as an important component of his vitamin therapy in psychiatric practice and most therapeutic formulas contain it.

There has been little association of vitamin *E* deficiency with personality disturbances. Spies and Vilter (137), however, in 1940 found that a deficiency of *E* appeared to cause a neurasthenic-like syndrome. There was no evidence of pellagra, beriberi, or ariboflavinosis, and there was response to vitamin *E* therapy. Harris (59) reports a study of Cinibal (27) in which supplemental *E* was given to children for three years. They were children who lacked the capacity to concentrate due to developmental disturbances. Cinibal credited *E* with their decrease in nervousness and irritability. They were able to sleep better and had increased sexual sensitivity.

Previous references have indicated that minerals are considered as essential to the functioning of the nervous system as to the rest of the body. With but few exceptions, however, the clinical reactions of the nervous system to mineral depletion have not been extensively studied. The indirect effects of iodine deficiency are recognized in the hypothyroid individual's apathy and mental sluggishness (103). More extreme consequences of the deficiency are seen in myxedema and cretinism. Vitamin *A* deficiency has also been found (80) to affect thyroid functioning. Massive doses of *A* improved the symptoms of hyperthyroidism (122).

Nervous system disturbances are observed to be associated with hypo-

chromic anemia. This form of anemia results from iron deficiency and is responsive to iron therapy. Evidence of emotional instability may precede development of the anemia and be aggravated by it, or may appear as the disease progresses, according to Jolliffe (78). Apathy, lassitude, increased anxiety, and irritability are commonly observed. If the condition has been longstanding there may be difficulty in swallowing which tends to cause increased apprehension and tension and often is interpreted erroneously as purely a nervous manifestation. Jolliffe recognizes the need for an accompanying psychotherapy in cases of hypochromic anemia that will give explanation, confidence, and encouragement, otherwise the symptoms may persist after the blood levels have risen as a result of iron therapy.

Saphir (111) reported a study of 10 soldiers whose psychoneurotic symptoms were found to be due to salt deficiency. The symptoms relating to the nervous system were headaches, dizziness, tremors, excessive sweating, nervousness, apprehension, restlessness, insomnia, loss of energy and strength, depression, personality changes, and anxiety. There was nothing in the history of these cases to lead Saphir to suspect low blood chloride levels. He suggested that perhaps some of the spontaneous improvements or even certain of the reports of psychotherapeutic success really may occur because rest, normal diet, diminution of physical activity, and sweating have succeeded in restoring the blood chloride level. Johnson (71) had reported similar findings earlier. In some instances excess salt may create insomnia and tension states, according to Miller (94).

Calcium deficiency is generally, though not always, associated with irritability and instability of the nervous system (102). Calcium is required for nerve impulse transmission (9). A calcium deficiency frequently occurs during the rapid growth of adolescence, at menstrual periods, during pregnancy and lactation. Calcium has relieved the associated nervous symptoms.

Hirschfelder and Haury (65) listed several cases in which hypermagnesemia was associated with somnolence and coma and hypomagnesemia with twitchings or convulsions.

Alteration in the mental states of patients with hypopotassemia is frequently a presenting symptom in the experience of Holly (66). Some individuals may be dull and apathetic while others may have restlessness as the first indication of the deficiency. In elderly individuals there often is delirium, disorientation, and confusion progressing into coma.

Other experiments and observations have contributed to the thesis that there is a relationship between nutritional deficiencies and emotional disorders. At the University of Minnesota (18, 47, 113) the reduction of the

caloric intake of 36 young men for 24 weeks produced an alteration in their behavior to the degree that it was referred to (113) as an "experimental neurosis" or a "starvation neurosis." The subjects' psychological measurements revealed depression, narrowing of interests, social introversion, preoccupation with thoughts of food, decrease in spontaneous activity (physical as well as mental), and marked diminution of libido. Typical of the change produced in the personality was their generalized description (18). A "pleasant, cheerful, active young man, full of initiative, coöperative and sociable, highly altruistic, sensitive to the world's social problems, eager to play his part in the world's rehabilitation" would become in 24 weeks "weak, edematous, lacking endurance and mental initiative, grouchy, self-centered, without interest in female companionship, childish slave to food, primarily concerned with individual security." Brozek (19) also reported a study of changes in men undergoing complete starvation for four days. The *MMPI* revealed a "large increment on the psychoneurotic scales."

The co-enzyme, glutathione, has reduced states of tension, anxiety, insomnia, and nervous irritability according to Ant's (1) experience with 45 patients. He concluded that in depression nutrients may be an important factor. Magee, according to Thomas (151), reported that small, between-meal snacks diminished the mental and physical strain of the bombings in England during World War II. Keister (79) learned that giving nursery school children pineapple juice about 10 A.M. decreased types of behavior that indicated fatigue, tension, irritability, or below-level functioning. Ganor and Dennett (49) found, among the effects of feeding 100 infants dried skim milk reinforced with a rice polish extract, improvement in mental alertness, sleeping habits, and lessened irritability in comparison to the behavior of 50 controls. The Sehams (117) determined there was increased motor restlessness in children with mild malnutrition, but with increased malnourishment, depression of activity. Tuttle and colleagues (152) had school boys omit breakfast for two, two-week periods. School authorities reported detrimental effects on attitudes and scholastic attainment, some becoming careless and inattentive during the late morning hours.

Glutamic acid in its various forms has often been tested as a possible mental stimulant, generally with animals or retarded children. The conclusions have been contradictory. Himwich and his staff (64) reported favorable results from feeding the monosodium salt of glutamic acid to 27 elderly, state hospital patients. A battery of 16 perceptual and motor tests revealed no significant changes, but on the basis of the six criteria selected by Menninger to assay behavior, 17 of the 27 patients improved. Sixteen

of the patients did better work in occupational therapy and showed more interest. Twelve improved in their emotional reactions, becoming more optimistic and cheerful. Nine were able to calculate and remember better. Himwich believes these results could be attributed to their using the monosodium salt of glutamic acid rather than other forms which are not so readily absorbed into the blood stream. The other studies with glutamic acid have not dealt with the subject under consideration.

Even a very slight revision of a diet may produce behavior changes. Spies (144) told of a child of nine who was given a skim milk supplement, the only change in his otherwise inadequate nurture. In a little over a year, with no other environmental change, his disposition was better, as were his school grades. His concentration and behavior improved markedly.

Several other reports have appeared in which physicians, psychiatrists, or psychologists have related their experiences with a therapeutic approach utilizing the contribution of nutrition (28, 34, 39, 42, 72, 86, 88, 93, 100, 166, 168). In 1941 Jolliffe (73) summarized his successful use of vitamins combined with a good diet in 3,000 cases most of which had associated neuropsychiatric disorders. He emphasized that he had never seen toxicity occur with vitamins, though sometimes there may be sensitivity to the preservatives in which they are bound. Ruffin (110) was one of the early physicians to recognize that in the treatment of mild vitamin deficiencies the most effective approach was to support vitamin supplementation not only with a diet high in protein and vegetables and low in refined carbohydrates, but also with the elimination of as much environmental stress as possible.

The details of two cases typical of the results he has obtained as a psychiatrist combining nutritional therapy with psychotherapy have been presented by Moriarty (95). In the first case, the patient was enabled to work more vigorously on her deep-level emotional conflicts after a month of nutritional therapy. In the other there was an unconscious use of nutritional and somatic symptoms by the patient to control her mother and to assuage guilt. These psychological aspects had to be cleared before nutritional therapy could assist in the complete alleviation.

Sieve, in a series of communications (121), discussed the etiology of 200 cases of nutritional disorders. In 50 of these an emotional upset was either a primary or secondary factor. The emotional disturbances led to "hormone dyscrasia and finally nutritional imbalance. . . . The realization that the psychic state is ill defined and may be of short duration, but may lead to important physical changes which can be treated successfully, would . . . benefit many of these so-called neurotic patients."

Washburn (160) recently reported the successful treatment of 14 out of 15 depressed adults with the aid of niacin and psychotherapy. In some cases improvement came within 24 hours. The average amount of niacin used was 900 mg. per day. In five of the cases higher amounts were given, one patient taking 2,500 mg. per day for a while. The one individual not responding was a 45-year-old woman apparently developing a schizophrenic condition. Characteristic of the changes noted by the patients were statements such as, "I have a sense of well-being." "I began to feel as though life was worth it." "Now I begin to understand many of the things we have been talking about." Gould of London (56), however, prefers intensive complete vitamin therapy to niacin alone with psychotherapy for neurotic and neurasthenic conditions as well as certain of the psychotic states.

Watson of the University of Southern California and Comrey of the University of California at Los Angeles have approached the relationship between emotional disturbances and nutrition not by creating deficiencies but by giving nutritional supplementation. A pilot study consisted of 32 subjects and 11 controls whose diets were considered adequate, but who were mentally ill. Thirteen markedly improved and 15 moderately on the *MMPI* as the result of taking a high potency, multivitamin formula (163). A median score of 22 points was made by the experimental group as against only one point increase in the median score of the controls. This difference was statistically significant. Impressive clinical changes were noted. Interesting aspects of this investigation were not only that it used subjects without clinical evidence of malnutrition, but that the nutritional supplements were higher and more inclusive than most heretofore reported. Watson of W. C. Kalash Laboratories, Pasadena, California followed up this experiment (162) with the subjects acting as their own controls. Of the 23 selected for the experiment on the basis of having one or more elevated scores on the *MMPI*, 19 finished the therapy. Sixteen of the 19 improved significantly, two made no change, one became worse according to clinical criteria. The *MMPI* score differences were all significantly in favor of the experimental period. A typical case from the summaries was that of a man who had been in a steadily increasing depression for about five years and said he didn't know whether he could keep going. At the end of the experimental period he recognized the "remarkable improvement" he had made and stated: "Now I'm a different person entirely. My likes and dislikes have changed. I like different music; I wear different clothes; my business associates say, 'You are a different person.'" Watson (161) has summarized the psychodynamics of one case as an example of the response to nutritional therapy of seemingly psychogenic symptoms.

Many surveys and reports of clinical experiences during periods of nutritional stress such as famine, war sieges, and internment camps have been published indicating psychological sequelae from malnutrition. They have not been considered in this paper because there has not been sufficient quantified evaluation of the psychological aspects nor has there been any way to distinguish the effects of the psychological stress from the deficiency stress. In 1944 a nutritional supplementation program was introduced to groups in Newfoundland (3). The consequent improvement noted included increased alertness, interest, and activity which could have been partially attributed, however, to a coincidental improvement in the economic condition of these submarginal income groups.

For similar reasons the psychopathology associated with the disease, kwashiorkor, prevalent in parts of the world with inadequate nutrition, has not been discussed. This syndrome is of interest because it is the consensus of investigators that it is caused by protein deficiency and there have been very few experiments relating protein deficiencies to psychological states. Symptoms of apathy, peevishness, and dullness are always associated with kwashiorkor (36).

In a study of the effects of breakfasts of various composition it was reported by Orent-Keiles and Hallman (98) that those providing larger quantities of protein-rich foods promoted a greater sense of well-being. Other knowledge of the essential rôle of protein in the nervous system metabolism comes from the laboratory where it has been found, for example, that vitamins must combine with protein to attain enzyme status (11). Two studies previously referred to should be recalled here: Himwich's work with glutamic acid (64) and the delineation by Sarett (112) and others of the fact that the amino acid tryptophane is converted in part to niacin.

The incidence of malnutrition associated with psychiatric problems has been variously estimated as occurring in from 10 per cent (95) to the majority of the patients (24). There has, however, been very little attention paid to their nutritional condition in relation to their psychotherapy. This is partly due to the subclinical nature of malnutrition in the general population, from which most psychiatric cases are somatically indistinguishable (25). The therapists who have used the psychonutritional approach would appear to agree with Campbell (24), for example, that it usually shortens the duration of ill health and not infrequently renders lengthy psychotherapeutic techniques unnecessary. He concludes that most psychiatric illnesses are the result of chronic tension, generally associated with prolonged malnutrition. He finds that the dietary needs of all patients in a state of

tension are greater than the normal requirements during good health. The more tense the patient or the longer the duration of the illness, the greater the nutritive requirements.

Investigators have been concerned with this problem of providing the increased nutritional needs. Spies (131) considers yeast and liver extract to be excellent therapeutic agents for the treatment of diseases arising from a deficiency of the *B*-complex. Campbell (24, 36) in part provides for the increased nutritional needs of his patients with a basic food supplement derived from the earlier experiments of Spies with yeast. Biskind (11) stresses the importance of liver and lists 13 incompletely identified factors that are now known to exist in it that have not been reproduced in laboratories. These may be found to be overlapping when completely identified. [Brewer's yeast, while a good source of most of the *B* vitamins and protein, has a calcium-phosphorous ratio of about 1 to 15, whereas, the desirable proportion for balanced nutrition is about 2 to 1 (178). The amounts of B_1 and B_2 are imbalanced, the former being too high. It is also lacking in at least one of the known *B* vitamins, B_{12} . Lindberg (87) secures a balanced formula by combining with the yeast, powdered skim milk, dessicated liver, and other ingredients that give nutritive palatability.]

Persons who have had prolonged periods of malnutrition or tension may have difficulty in assimilating food supplements as high in protein as these. Campbell (24) has called attention to the beneficial effects of glutamic acid hydrochloride. When it is insufficient to overcome any nausea, flatulence, or diarrhea, he uses in addition, the digestive enzymes.

Several significant developments may be observed in the psychonutritional aspects of deficiency states. Probably the most interesting is the introduction of extremely high potency and multiple vitamin and mineral supplementation (56, 163). Some aspects of research in animal experimentation would appear to support this approach. Williams, discoverer of pantothenic acid, has formulated his genetrophic theory to explain his finding that some animals require higher amounts of nutritional elements than others (173). He considers an hereditary factor may account for it. The production of congenital malformations by the nutritional teratologists would suggest the possibility that the need may be a systemic congenital anomaly. An experiment of Pottenger's (104) appears related. He found that cats forced to eat only processed foods deteriorated to the extent that within three generations they could not reproduce. The theory is suggested that some individuals because of nutritional degeneration may have abnormally high needs for nutritional therapy.

Campbell's experience that malnutrition exists in almost all psychiatric patients needs to be verified experimentally. His practical approach of using a highly nutritious food supplement is adaptable to most individuals, and may also be considered preventative.

The Gillmans (50) have questioned some of the nutritional therapy that has been used. They refer to Walshe's (158) dissatisfaction with either thiamin or the *B*-complex as a specific for polyneuritis, to Farrar's (43) unsatisfactory results with large amounts of thiamin. Others (85, 107), for example, have had anaphylactic shock occur with large amounts of *B*₁, generally intravenously administered. Gould (56) describes the possible toxic effects from experimentally imbalancing a formula with excessive amounts of the various single vitamins. Both the competent clinician and the medical investigator realize the complexity of the biochemical factors of metabolism and the multiple malfunctions that may either produce or derive from a deficiency state. They do not regard vitamin therapy as practiced by the experienced physician to have toxic effects. They emphasize the use of all indicated therapies, the importance of a good basic diet, and balanced vitamin formulas (11, 24, 60, 84, 100, 110, 129).

Investigators appear to be in agreement with Spies that the deficiency diseases usually occur simultaneously and present a complex clinical picture (129). There has been, however, much clinical and experimental work with large amounts of one or two vitamins. There is concurrence that while all patients with neurotic symptoms are not necessarily nutritionally deficient, their nutritional status should be determined. According to present knowledge, the distinction of psychopathological syndromes in the subclinical deficiency states is more a convenience than a scientific accuracy, and vitamin therapy cannot be considered specific (11, 123, 129), although there are indications that syndromes may be distinguishable eventually (56). Also, as Biskind states (11), it is a misconception to consider that deficiencies of single factors exist or can be treated with absolute certainty until all the elements comprising our foods are known. These unknown aspects, however, in no way preclude the improvement of symptoms by means of the best methods currently available for psychonutritional therapy. They should encourage the further refinement of our psychometric techniques and nutritional knowledge in order that experimental work keep pace with clinical and biochemical advancement in the multidiscipline approach.

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THE STABLEMATE CONCEPT OF THERAPY AS AFFECTED BY LSD IN SCHIZOPHRENIA*¹

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A. INTRODUCTION

It is generally agreed that the identification processes are disturbed in the schizophrenic state (3, 11). The frames of reference used by the non-psychotic individual during the adaptation process in daily living are to a certain extent replaced in the schizophrenic individual by internalized symbolic versions of the poignant personalized parts of the schizophrenic's environment. It appeared to the authors that a study of a special type of group process might provide: (a) a better understanding of the nature of the distorted identification process, and (b) improved techniques for communicating with schizophrenic patients, thereby developing better methods of therapy.

Although group methods have previously been employed with the relatives of schizophrenic patients or with other psychotic patients, the present investigation was designed to avoid the conflict situation produced by group therapy with relatives and the contaminated situation produced by contact with other schizophrenics.

We have therefore set up a group process for study which involves contact of a schizophrenic patient only with non-psychotic individuals. Our group consists of (a) the patient, (b) a stablemate, the second member of the group who is in general of the same age and sex as the patient himself, and (c) the interviewer who, in our study, is a scientifically trained, psychiatrically sympathetic and emotionally suitable person for the experiment. In general, we feel that the interviewer, or group leader, need not be a trained psychiatrist but should be part of a psychiatric group with adequate psychiatric guidance. This technique avoids the use of highly trained personnel and

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makes possible an approach to the psychotherapy of the schizophrenic patient by such non-technical personnel who can understand the nature of the reconstruction process involved in relieving the confusion engendered by abnormal frames of reference for identification. As a matter of fact, in our project the stablemate and the group leader are unpaid volunteers.

B. THE STABLEMATE CONCEPT OF GROUP THERAPY

Masserman (8) has described how cats, rendered "neurotic" by air blasts at the food box, may recover previous behavior when a normal cat is placed in the box with the neurotic one. The normal cat goes to the food box readily.

The stablemate concept might be visualized by considering what occurs when two horses from the same stable are entered in a race. The potentially winning horse, by having a familiar partner in the race to whom he is conditioned, is motivated to overcome the stresses of a strange competition because of adaptation to a familiar and safe object, the stablemate. Everyone is familiar with the ways in which a leader collects followers whose actions are patterned after those of the one who shows how something may and can be done. It was the thought of the senior author that this phenomenon might be used to advantage in the psychotherapy of schizophrenia. Earlier experiences led to the hope that under the action of *LSD* this process of identification with a stablemate might be potentiated.

1. *Description of Stablemate Interview Situation*

The present experiments were conducted in the special section of the Research Division of the State Hospital at Central Islip, New York. A tape recorder with its microphone concealed in a small radio cabinet was in an adjoining room which was equipped with a one-way screen.

Three elements were used to structure the interview: (a) the patient was given either a placebo or *LSD-25* in tap water; (b) the questionnaire, previously employed to study *LSD* in non-psychotics, was used as a basis for interrogation (1), and (c) selected pictures of the Thematic Apperception Test (9) were discussed. However, as occasion demanded, games or unstructured discussion was permitted. The formal therapeutic interview, in general, lasted approximately three hours. Interviews were conducted once a week. Some experiments lasted over a period of several months for a single patient, others for two weeks. The taped interviews were transcribed, and the questionnaire charts were analyzed. Content analyses of the group interactions were made by content analysis techniques and by modifications of the Bales' categories (2). The details of the con-

tent analysis code for therapy interactions will be described later. The general nature of the technique used was described to some extent in a previous paper (7). The following examples illustrate some of the categories of the content analysis used:

Positive Affective Statement Towards or About Self

Examples: "I am very happy today"
"I liked to be with nice people"

Negative Affect Towards or About Self

Examples: "I am very anxious"
"I want to go home badly"

Positive Affective Statements Towards or About Others

Examples: "That's very kind of you"
"He looks as if he loves her"
"She looks as if she has just given birth and is very, very happy to have just given birth"

Negative Affective Statements Towards or About Others

Examples: "She looks frantic"
"She is afraid of the darkness"

Mixed Affective Statements Towards or About Others

Example: "She feels strange"

Statements Referring to Positive Affect of Others Towards Self

Examples: "The doctor seems to like me"
"The other patients like me to talk to them and mother them"

Statements Referring to Negative Affect of Others Towards Self

Example: "The patients always try to annoy me"

Statements Without Affective Content

Examples: "Today is Tuesday"
"We keep our clothes in a clothes room"

2. Experiences of "Stablemate"

The stablemate in this experiment was a 39-year-old married woman, mother of two children. The education and experience of the stablemate were essentially in secretarial work. She was somewhat apprehensive at the outset, never having been inside a mental institution before and fearing that she might say or do the wrong thing and thus jeopardize the experiment. At first, the stablemate had headache and insomnia each night after the group meeting. After explanations and encouragement to relax and to avoid structuring the situation or conversation, she became much less apprehensive and was shortly able to look upon the sessions with various patients as interesting experiences.

The stablemate reported that upon two separate occasions, with two different patients, she experienced a fleeting moment of utter confusion. She had to force herself back to reality—mentally shake herself in order to recover control of her thoughts. She could not understand this feeling and wondered if perhaps she was being affected by her association with these patients. This terrified her and, unfortunately, she was afraid to ask for help immediately. Later, during a conference on the experiment, while identification process of schizophrenic with normal was being discussed, it suddenly dawned on her that it might be possible for the identification process to reverse itself, and if so, what had occurred was a momentary identification of the normal with the schizophrenic. Only then was she able to tell us about her feelings during this experience. These experiences have not recurred.

C. EXPERIMENTAL

Although it has been reported that certain schizophrenics do not respond to small doses of *LSD-25* (4, 10) we have begun an extended study of hospitalized schizophrenics who are sufficiently capable of communicating in the group situation to ascertain if this group responds to *LSD-25* similarly to normal individuals. The experiments were run so that the stablemate always received a placebo with the schizophrenic receiving either a placebo or *LSD-25*.

The type of patient that we have been studying usually responds to 50 mcg of *LSD-25* taken orally when studied by our technique. The questionnaire method has been found to be not as useful with schizophrenic patients as with non-psychotic individuals.

1. *Observations and Results*

At the present time data for two series have been partly analyzed. Each series involving one schizophrenic patient lasted over several months. All of the group sessions were recorded and transcribed. It was possible to undertake the Bales' and content analyses for most of the sessions. The findings reported below are based on eight sessions for Patient *A* (four placebo and four *LSD* sessions) and on seven sessions for Patient *B* (three placebo and four *LSD* sessions). The transcripts of some individual sessions exceed 100 pages.

While almost all of the real relationships in the data show a similar trend in both series, we feel that further analysis of our data as well as replications of our studies are in order before full confidence can be placed in the findings. Selected findings are given in Table 1.

TABLE 1
RELATIONSHIP BETWEEN NUMBER OF PATIENT AND STABLEMATE INTERACTIONS IN
LSD AND PLACEBO SESSIONS

	Series A		Series B	
	Placebo (four sessions)	<i>LSD</i> (four sessions)	Placebo (three sessions)	<i>LSD</i> (four sessions)
Number of patient interactions	403	445	1,372	2,095
Number of stablemate interactions	404	381	1,171	1,269
Ratio	1.0	1.2	1.2	1.7

The data in Table 1 indicate that the ratio of patient interaction to stablemate interaction is higher for the *LSD* than for the placebo sessions. For Series A this increase is about 20 per cent and for Series B about 50 per cent. Under *LSD* then the patient's participation in the group process is increased relative to that of the stablemate. Patient's increased participation could be interpreted as an indication of more patient interest in and more patient awareness of the interaction situation. It may also be the result of some intra-group mechanisms involving patient and stablemate which is brought about by the administration of *LSD* to the patient.

In Table 1 we have seen that patient's participation increases in the *LSD* sessions; that is, the patient speaks more often. However, it would have been conceivable that though the patient speaks more often, he contributes as much or less (in terms of quantity) than in the placebo sessions. Table 2

TABLE 2
RELATIONSHIP BETWEEN AMOUNT OF PATIENT VERBAL CONTRIBUTION TO STABLEMATE
VERBAL CONTRIBUTION IN *LSD* AND PLACEBO SESSIONS

	Series A		Series B	
	Placebo (four sessions)	<i>LSD</i> (four sessions)	Placebo (three sessions)	<i>LSD</i> (four sessions)
Patient's verbal contribution (in lines)	764	793	2,964	4,909
Stablemate's verbal contribution (in lines)	1,083	981	1,749	2,153
Ratio	0.7	0.8	1.6	2.3

shows that quantity of verbal input by patient is also increased in the *LSD* sessions. This increase amounts to about 10 per cent for Series A and to about 50 per cent for Series B. For Series A the data also manifests a downward trend for the ratio over time. The decrease in ratio over time occurs both for the *LSD* and the placebo sessions. This trend seems to be a factor in the comparatively lower increase noted for Series A than for Series B.

The relationships emerging from Table 1 and Table 2 should be considered complementary. They point to two aspects of increased patient participation (frequency of interaction and the amount of verbal contribution) which are noticeable for the *LSD* sessions.

TABLE 3
THE RELATIONSHIP BETWEEN SELF-ORIENTED AFFECTIVE STATEMENTS AND OTHER-ORIENTED AFFECTIVE STATEMENTS FOR PATIENT IN *LSD* AND PLACEBO SESSIONS

	Series A		Series B	
	Placebo (three sessions)	<i>LSD</i> (two sessions)	Placebo (three sessions)	<i>LSD</i> (four sessions)
No. of self-oriented affective statements	62	23	89	78
No. of other-oriented affective statements	25	37	63	77
Ratio	2.5	0.6	1.4	1.0

TABLE 4
THE RELATIONSHIP BETWEEN OTHER-ORIENTED STATEMENTS AND NON-PERSON ORIENTED STATEMENTS FOR PATIENT IN *LSD* AND PLACEBO SESSIONS

	Series B*							
	Placebo				<i>LSD</i>			
	Oct. 11	Nov. 8	Nov. 29	Total	Oct. 25	Nov. 2	Nov. 15	Dec. 6
No. of other-oriented statements	241	138	110	489	207	80	137	158
No. of non-person oriented statements	126	96	92	314	36	37	64	65
Ratio	1.8	1.4	1.2	1.5	5.7	2.2	2.1	2.6
								202
								2.9

*Data available for Series B only because category of non-person oriented statement had not been included in content analysis of Series A.

Tables 3-5 are based on the content and Bales' analyses of the verbatim data. The categories of the content analysis have been briefly illustrated earlier in the paper. We believe that the "target" reference of a communication is related to the involvement of an individual with himself or with the group situation. The ratio of Self-Oriented Affective Statements is considerably greater in the placebo than in the *LSD* sessions in both Series A and in Series B. This implies that during *LSD* the patient's affective references revolving around the self decrease and affective references toward or centering around other persons increase.

While we previously noted increased patient participation under *LSD*,

we now note that this increased participation and communication is *other* directed. It is on the basis of these findings that we tentatively suggest that *LSD* might prove useful in facilitating communication in psychotherapy.

We noted that during the *LSD* sessions the number of non-person oriented references on the part of the patient decrease considerably and the number of other-oriented references increase. This further documents the point made in relation to Table 3. It seems that under *LSD* both self-oriented and non-person oriented references decrease while references toward and about others show a steady and considerable increase.

TABLE 5
THE RATIO OF EXPRESSIVE TO INSTRUMENTAL ACTIVITY FOR PATIENT IN *LSD* AND PLACEBO SESSIONS

	Series A*		3/1	<i>LSD</i> 3/15	Total
	2/9	Placebo 3/22			
No. of expressive acts**	19	24	43	19	63
No. of instrumental acts***	129	183	312	86	278
Ratio	0.15	0.13	0.14	0.22	0.23

*Data not available on Series B for this dimension since Bales' coding of this series has not yet been completed.

***Expressive Acts* include the showing of solidarity and antagonism, the showing of tension and of tension release, the expression of agreement and disagreement. They pertain to the socio-emotional area.

****Instrumental Acts* include the giving and asking for orientation, the giving and asking for opinion, the giving and asking for suggestion. They pertain to the task area.

(a). The ratio of expressive to instrumental acts is almost twice as high for the patient during the *LSD* sessions than during the placebo sessions.

(b). This finding is to some extent but by no means wholly accounted for by the greater number of laughter acts under the *LSD* condition.

(c). The *change in the ratio* between the two kinds of behaviors occurring for this patient under the two conditions should be contrasted to the *stability in the ratio* of expressive to instrumental activity found in our group experiment with "normal" subjects (7).

(d). This difference from the reaction of "normals" to *LSD* is interesting since contrary to some previous claims (4, 10) the schizophrenic patient shows *more* change in behavior (in this aspect) than do the normals. In other words the chronic schizophrenic responds to the same small dose of *LSD* as does the "normal," but the response is not the same in the two.

D. COMMENTS

In the design of this present experiment we were first concerned to test the stablemate hypothesis, second to test the hypothesis that identification by a schizophrenic with a normal person might take place under the conditions of the test. Corollary to this we wished to ascertain whether *LSD* would alter the disposition of psychic "forces" in the schizophrenic, and if so, whether this would favor the identification process. We were not quite prepared for the degree to which this change did occur. It may prove salutary to comment on the implications of what happened as a consequence of our inability to spend the time or to devote the attention to the patients following *LSD*, which their response to *LSD* called for.

The arrangement was such that the medication or placebo was administered about 10:30 A.M. This would be followed by interviewing during the next four to six hours. During this time, in the earlier experiments, the patient briefly returned to the ward for lunch; later lunch was shared by interviewer, stablemate, and subject. Following the departure of the interviewer and stablemate, it was the custom of one of us to visit the ward, where usually, the patient would be spoken with unless she herself withdrew, e.g., by going to the lavatory. The patients were never in doubt as to whether or not they had received medication, even when the dose was as low as 40 micrograms of *LSD*. Often they inquired, "What did you do to me?" "What has happened? My mind won't hold still. My legs feel funny. Oh, oh, oh, . . . this is something." In this state there was almost invariably an intensification of clinging dependency. The few apparent exceptions were transparently intensifications of prior defensive behavioral patterns, e.g., R.S. and B.R., both of whom became more withdrawn, mute, and giggly.

By checking back over the content of the patients' communications during the *LSD* sessions, and by reference to the attitudes to the interviewers expressed subsequent to the sessions, it was evident that the patients had formed hopes of someone listening to them, being genuinely interested, and of "doing something" (magical?) which would change everything for the better. This degree of expectation is rarely encountered with this type of patient. It seems directly related to the stablemate design of the experiment.

The immediate consequences of *LSD* were often followed within a few days, or in some instances after the second or third visit of the interviewing pair, with or without subsequent *LSD*, by increasing agitation, expressions of despair, and interferences with thought processes. In A.R., for instance,

the patient who had felt guilty and sinful and thought that she should be killed, increased her stealing, tried to make love to a passing male patient, cried, wrote letters to the sheriff to arrest her so she might be executed, and finally became so suicidal we had to offer her maximal protection. A.B. lost weight, became very restless, increased her water drinking and consequent urination (her form of infantile sexual gratification), sighed constantly for a lover and a baby to have for her own. She went on to sitting naked on the bathroom floor, and her inability to eat became so alarming we had to transfer her to less exciting and threatening surroundings. There she improved after a period of several months to her prior state.

We recognize that these observations are not entirely new. The long delayed reactions to *LSD* sometimes reported (6) are, we believe, more psychological than pharmacological, and are to be understood as the consequence of release of preconscious or unconscious material. This may be of no great consequence in relatively normal persons, or in those who dissociate affect and content, or in those whose contact with a psychotherapist or friend is sufficiently supportive, but in the psychotic it can be disruptive.

We hope that these studies may lead to a new type of therapeutic approach. This procedure would endeavor to reconstruct the schizophrenic personality via the route of identification with a non-psychotic group. It appears that *LSD-25* may facilitate this process.

E. SUMMARY

1. Group process for study involving contact of schizophrenic patients with non-psychotic individuals is described. A non-psychotic "stablemate" is the second member of the group. The psychotic patient and the non-psychotic stablemate formed a therapeutic group with a third person, the group leader.

2. Under *LSD* the patient's participation in the group process is increased. Both the frequency of patient interaction and the amount of patient verbal contribution in the group situation is higher in the *LSD* than in the placebo sessions.

3. Under *LSD* the patient's affective references revolving around the self decrease and affective references toward or centering around other persons increase.

4. Under *LSD* the patient's non-personal references decrease and other-oriented references increase.

5. The ratio of expressive to instrumental acts is almost twice as high for the patient during the *LSD* sessions than during the placebo sessions.

6. On the average the patients exhibit a higher ratio of positive over negative socio-emotional acts during the *LSD* sessions than during the placebo sessions.

7. In general, there is just as much if not more change of behavior under *LSD* for schizophrenic patients than for "normal" subjects.

8. Communication between patient and stablemate during *LSD* sessions is characterized by a greater amount of other-oriented references than during placebo sessions.

9. The release of preconscious material is associated with greatly increased anacritic needs.

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THE MOVEMENT OF GROUND OVER FIGURE: A NEW FORM OF APPARENT MOVEMENT*

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A. PURPOSE

Many experimenters (2) have specified the conditions for apparent movement. This report describes a radically different kind of movement in which the ground, rather than the figure, appears to move. The simplified and inexpensive apparatus used will be described in detail.

B. APPARATUS

The variable speed interval switch can be constructed by a shop man with only modest skill and largely with scrap material. The most expensive component is the motor.

The stimuli were two three-watt neon lamps (GE NE 40) which have virtually no afterglow. The circuit breaking device (Figure 1) operates in the following way: The shaft of a 60-cycle, 1/10 HP, 1,725 RPM motor drives a belt which turns a pulley directly above the shaft. The axle of the pulley passes through a bearing mounted in a plate fastened to the motor; at the end of the axle is a $\frac{1}{4}$ " x 4" diameter fiber disk. A spring holds the disk firmly against a small wheel, mounted on a vertical axle, which revolves whenever the disk turns.

Variable speed is obtained by turning the handle of the vertical screw; the screw is threaded through a nut, on which is mounted a yoke. The yoke engages a collar on the take-off wheel. Turning the handle raises or lowers the yoke, which moves the take-off wheel toward or away from the center of the driving disk, causing the take-off wheel to revolve at varying speeds.

A bakelite cylinder, on which copper collars are pressed, is pressed on the lower end of the axle of the take-off wheel. A notch is cut out of one end of each collar. Since the notch is three-quarters of the circumference, what remains are two copper cylinders, each with a tab at one end that is one-

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¹This paper was reported in part at the 1954 meeting of the American Psychological Association. Mr. Emory L. Simpson contributed the basic design of the apparatus described here and Mr. Richard Bugbee at the University of California contributed certain refinements.

quarter of the circumference. The tab is the circuit-breaking unit. The upper collar is used for the neon lamps; the lower one for calibration. The following description applies to the upper collar:

A copper brush (*A*) carries 110-volt current into the collar. Two other brushes (*B* and *C*) are placed so that they make contact only with the tab. Brush *B* is connected to one terminal of one lamp and Brush *C* is connected to one terminal of the other lamp. The remaining terminals are fastened to a common lead.

Variable Speed Interval Switch

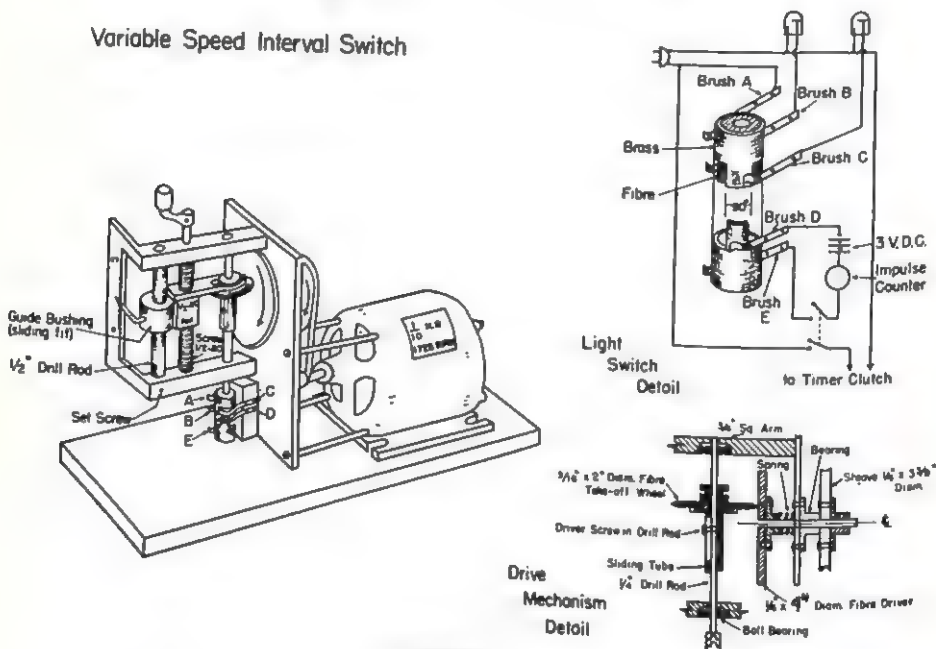


FIGURE 1

For the first $\frac{1}{4}$ revolution, the current flows into the collar, through the tab and one of the brushes into one lamp and through the common lead. During the next quarter turn the circuit is broken. The next quarter turn carries current into the other lamp. The final quarter turn leaves both lamps dark.

Thus, turning the screw moves the take-off wheel to vary the *RPM* of the cylinder continuously. This changes the duration of the dark interval and the duration of the lights. The dark interval is always the same as the light interval at any given setting.

The number of *RPM* is counted by a Klopsteg Counter (4) attached in series to a timer. The lower collar energizes the counter and timer in the

same way that the upper collar energizes the lights (Brushes *D* and *E*). It was found that reliability was extremely high: the largest difference on different trials was 3 *RPM* at high speeds. A pointer attached to the nut shows the position of the take-off wheel on a scale of *RPM* fastened next to the screw. This is converted into milliseconds, which shows the duration of the dark interval. The counter can remain attached so that the scale can be periodically checked.

The lamps, horizontally mounted, are enclosed in small light-tight boxes (chalk boxes) with a $\frac{1}{4}$ " hole at one end through which the top of the lamp and the filament can be seen. The distance between lamps and their distance from the switch can be varied. The unit can be transported easily by one person.

C. SUBJECTS

The subjects were 206 adults, mostly college students, divided equally by sex. Ages ranged from 18 to 47.

D. PROCEDURE

The findings reported in this paper are largely a by-product of another investigation (1). Several different procedures were used, but most of the observations were made under the following conditions: The subject was seated 14 feet from the lights which were three inches apart and at eye level. When the room lights were turned off, nothing was visible save the two small neon lamps blinking on and off. The subjects, individually tested, were told about the phi phenomenon and that they could expect at different times to see two lights blinking alternately, a single light moving back and forth, and two lights blinking simultaneously. They were to report what they saw, and particularly when any changes occurred. A reading was made for each reported change. Subjects were further told to report any other observations, whether they seemed to be reasonable or not. They were shown the apparatus and the boxes.

The room lights were extinguished and the phi apparatus was started at "slow," the maximum time interval between lights (500 milliseconds). The time interval was gradually shortened until movement was reported. A reading was taken and the time interval further decreased to "fast," until simultaneity was reported. Serial exploration was continued by starting at the fast end and increasing the time interval. Four slow-to-fast and four fast-to-slow measures were taken at the first sitting. A second set of measures was taken at a later date. Many variations of this basic procedure were tried; these will be indicated in the section on results.

This experiment was repeated with comparable results by five different experimenters in six different locations.

E. RESULTS AND DISCUSSION

The phenomena thus far indicated have been described by many observers. The order—alternation, movement, simultaneity—has been stable when the time interval is shortened; the reverse order is found when the time interval is lengthened. In addition to these three phenomena, Wertheimer (6) and others, using trained observers, have reported something called "pure phi" which is a kind of prelude to the perception of a moving object.

One of the first subjects reported a "gray thing" moving back and forth in front of the lights. This was assumed to be pure phi, *à la* Dimmick (3). Similar reports by later subjects were also dismissed in this fashion until two subjects failed to report a moving light, but did report the gray thing over large ranges. It became apparent that this was not pure phi. Pure phi had been specified as always coming between alternation and movement; it could be seen only by observers trained in the Titchenerian structuralist school; nothing obscured the lights; and nothing moved.

The phenomenon reported here occurred only between movement and simultaneity and was pointed out by completely naïve observers.

One group of 20 subjects was given no instructions except "Tell me what you see." They were not shown the apparatus, nor given any other set. The "gray thing" was reported by many subjects, but the color varied. The term used most frequently was "shutter," but it was also described as a square, a pendulum, a dark rectangular thing, a piece of gray, a tennis paddle, a railroad wig-wag, a piece of cardboard, a purple patch, something, a black thing, the experimenter's hand, a piece of cardboard on a wheel, a dark green spot, a black square column, a green shadow, etc. The colors varied widely. The commonest was gray; the next most common was black. Others included orange, red, green, purple, blue, and "colorless." Sometimes it was well structured. Sometimes it was a blob. But it was always tangible, it was always in front of the lights, and it always appeared between reports of movement and simultaneity. The shutter and movement of the light were mutually exclusive.

Some subjects in this group reported the shutter or variation quite freely, but did not volunteer the information that they saw a light moving until after they were asked specifically about it.

The majority of the subjects were tested under the well-structured set of

instructions described under "Procedure" which included a strong suggestion that movement of a light was expected. Of the 40 subjects first tested under carefully controlled conditions, 31 reported the shutter or equivalent at least once. These reports were indistinguishable from those of the unstructured group except that reports of the shutter were often made with some hesitancy and frequently were prefaced with remarks like "It must be just me, but . . ." or "I guess I must be tired, but . . ." or "I know it isn't there, but . . ."

Some subjects reported the shutter on every trial; others reported it only once or twice; a few not at all. It appeared most frequently when the trial started with a setting that was faster than the threshold for simultaneity-movement. Sometimes the shutter would persist to the slowest speed the apparatus could produce (500 milliseconds). Some subjects reported the shutter at the fastest speed obtainable (37 milliseconds), which was at a much higher speed than for any report made of a light moving (50 milliseconds).

The balance of the subjects were obtained at a later time at two other universities, and with four other experimenters. The reports were identical with those made to the writer.

The shutter effect seems to be stable; it is compelling but not universal—at least not with this apparatus. A careful search of the literature failed to show any previous mention of this phenomenon. Dimmick's "gray flash" (pure phi) is qualitatively and quantitatively different from the shutter.

The phi phenomenon has been under investigation for almost half a century. The question arises, Why has the shutter effect not been reported? Part of the answer undoubtedly is that no one has used this particular arrangement of stimuli before. They were comparatively bright and stable-looking, repetitive, appeared in a completely dark field, could be varied over large time intervals, and the duration of the lights was equal to the pause between the lights. Early experimenters used tachistoscopic presentations, each stimulus appearing only once in a trial. Later ones using repetitive presentations usually included a visible background. The critical variable appears to be the totally dark field in which the lights appear.

Changes were introduced to destroy the shutter effect, but, given appropriate time intervals, the only change that eliminated the shutter effect was illumination of the area around the lights. The phi phenomenon can continue even with some light, but the shutter effect seems to demand almost total darkness. As soon as the subject can perceive the structure of the immediate surroundings, the shutter disappears.

The shutter appears to be constructed out of part of a completely homogeneous field. As the surroundings become visible, the structure prevents such a separating out of a portion of the field so no shutter is visible. As Koffka (5) said: "A thing is a particularly well integrated part of the total field. The stronger its integration, the stronger the forces which hold it together. . . ."

No theory has yet been developed to account for the shutter effect. One might suggest that the structure of the nervous system is such that movement will be perceived whenever possible, as a sort of survival mechanism. It may be, then, that these stimuli were so well-structured and appeared in such rapid sequence that the usual phi-movement was impossible. The organism then perceived a part of the unstructured ground as carrying the motion back and forth in front of the lights. A similar thought is that there is need to organize the environment: under these particular conditions the environment makes more sense if motion is seen, but the lights are too stable to move at such a high rate of speed. In either case, one must assume that the nervous system, because of its structure, codes the presented information in such a way that movement is seen.

The subjects used were essentially naïve: the shutter effect is not a delicate phenomenon to be observed only by trained introspectionists, nor can it be laid at the door of suggestion. If the mechanism of suggestion be invoked, it must be used to work against reports of the shutter effect.

F. SUMMARY

A hitherto unreported perceptual phenomenon was discovered during an experiment on apparent movement. The apparatus used, which is described in detail, presented two small lights alternately at continuously varying intervals. In addition to the expected reports of movement of the lights, subjects reported seeing an object of varying structure passing back and forth in front of the lights, like a shutter. The shutter seemed to be constructed out of the totally dark field in which the lights were presented. No current theory seems to account for this phenomenon.

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THE PLACE OF PRIVATE PRACTICE IN PROFESSIONAL PSYCHOLOGY*

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A. INTRODUCTION

In his "1984" (12) Orwell describes an authoritarian society with dogmas which everyone is forced to believe in and live by. These are (a) war is peace; (b) freedom is slavery; (c) ignorance is strength. He also describes methods used to make sure that these dogmas are believed by all. The methods described are sure fire ways of making up history rather than describing it and they include three steps: (a) the past is erased; (b) the erasure is forgotten; (c) the lie becomes truth.

To some extent a reading of present day psychological literature all too often gives one the impression that psychology as a profession started just a few years ago by the people in practice today, as if it had no ancestry or no past, or else had come through the processes suggested by Orwell and had successfully erased all of the past. By so doing the danger is that we forget that our present needs can be better understood in the light of the knowledge of the past—what took place there and how we got this way. Growing up does mean selective outgrowing, but it does not mean throwing everything overboard that is marked historical or past. Growing up means interdependence with emerging realities and continuity as well as change for confronting present realities.

B. NEED FOR PERSPECTIVE

Our professional need in the sense of coping with the present reminds me of a story of a girl who considered herself smart, talking to a girl whom she considered to be very dumb. The dumb one seemed not to grasp readily the self-appointed sophisticated girl's talk about the facts of life. The bright one, fed up with the seeming inability of the dumb one to grasp what she said, came out with: "What's the use of talking to you. You don't even

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know who made you!" The response of the so-called dummy was, "Do you mean originally or recently?"

"History," as Muller (11) likes to tell us, "has no meaning, in the sense of a clear pattern or determinate plot; but it is not simply meaningless or pointless. It has no certain meaning because man is free to give it various possible meanings." Without getting lost in history it might be well for us to start with a historical look at how we started and how we carried on in a manner that led up to the present. De-emphasized in our presentation will be recent material readily available. Included will be material wittingly or unwittingly omitted in "America's Psychologists" (3) and supplementary material concerning private practice.

C. IN THE BEGINNING THERE WAS CATTELL

Of the greats in psychology, Cattell was the first to show interest in the development of an applied psychology. In 1929, as president of the Ninth International Congress of Psychology, Cattell looked over the field and announced that: "A history of psychology in America in the last fifty years would be as short as a book on snakes in Ireland since the time of St. Patrick. In so far as psychologists are concerned, America was then like Heaven, for there was not a damned soul there" (1, p. 441).

From the very beginning Cattell was interested in turning psychology into a profession as well as a science. In his later years, particularly, he took every opportunity to help it move that way. Some illustrative statements, selected in the form of key sentences, include the following:

"It seems to me certain that experimental psychology has wide-reaching practical applications, not only in education, but also in medicine, in the fine arts, in political economy and, indeed, in the whole conduct of life" (1, p. 482).

"Psychology may supply economic values equal to those of the physical and biological sciences, human values of even greater significance" (1, p. 484).

"What we need is a science that will coördinate all efforts to control conduct with the effects of all changes in the environment. This is the primary business of psychology; it requires the coöperation of all the sciences and of all the professions" (1, p. 489).

"For the present the psychological expert should doubtless be a member of one of the recognized professions who has the natural endowments, special training, and definite knowledge of the conditions that will make his advice and assistance of value. But in the end there will be not only a science but also a profession of psychology" (1, p. 207).

In the twenties a number of developments took place which moved the

field in the direction of increasing professional emphasis. Cattell himself helped found and develop the Psychological Corporation in 1921. This organization, particularly in the administration of Dr. Paul Achilles, stimulated an interest in the application of psychology. In the early twenties newly organized child guidance clinics in selected cities in the United States, sponsored by the National Committee of Mental Hygiene and supported by the Commonwealth Fund² introduced the use of a team of professionals composed of psychiatrists, psychologists, and psychiatric social workers. This opened up a field where clinical psychologists could get experience in and also develop interests in clinical applications. The consequences of World War I helped yield an increased interest in professional application in industry as well as educational institutions. These and related developments moved in the direction of a good many people in the American Psychological Association of that day not being satisfied with the attention given the applied field by the parent body and moving in the direction of organizing the American Association for Applied Psychology.

D. MATURING WITH THE *AAAP*

The organization of the *AAAP* represented a new landmark for the field of applied psychology.³ The purposes of the *AAAP* and its immediate predecessors are described in a report published in the first issue of the *Journal of Consulting Psychology* (6). The then existing national and regional associations of applied psychology, the Association of Consulting Psychologists and the Clinical Section of the Psychological Association amalgamated their interests in the new national society.

The lead article in the first issue of the *Journal of Consulting Psychology* was by Cattell, the title: "Retrospect: Psychology as a Profession" (2). The follow-up article was fittingly enough by Cattell's successor at Columbia University, Dr. R. S. Woodworth, under the title of "The Future of Clinical Psychology" (22). In this article Professor Woodworth questioned the title of clinical psychology because it suggested bedside and argued that people coming to psychologists are neither bedridden, nor sick in the usual sense. His opinion at that time was that "consulting psychology" might be a better title, though not perfect. "Personal service psychology" had more appeal to him even though he could see flaws in this too. His impression at that time was that "the profession of personal service psy-

²See Stevenson (15) for a description of the growth of the child guidance movement.

³For a survey of professional psychology up to 1950, see (7), and the early issues of the *Journal of Consulting Psychology*, particularly the statement made by the editor in (18).

chology is going to be a large, highly varied but unified profession. It will be large enough and unified enough and well enough equipped with knowledge and technique to stand on its own feet and to coöperate on terms of mutual respect with other professional groups which also engage in personal service." In this article, too, Woodworth warned about the vacuum being filled by an inrush of half-trained and semi-scientific practitioners unless the leaders in the profession are successful in their efforts to maintain and raise standards. "A legal right charlatans have in most states still," said he, and they still have. His hope was "... as the profession grows in competence and in numbers its influence and authority will increase." In a sense this can be said to be a more tangible addition to Cattell's more vague hope for psychology as a profession.

In a 1940 issue of the *Journal of Consulting Psychology*, Donald G. Paterson (13) already assumed that applied psychology had come of age. He divided the historical account of the growth of applied psychology into three periods: "The first period covers the prenatal stirrings of an embryonic science, extending from the last two decades of the nineteenth century until America's entrance into the World War" (p. 1). He adds:

It is our contention that the birth-labor of applied psychology began in April, 1917, and was completed on the day of the Armistice in 1918. The period of infancy, childhood, and adolescence occurred during the "golden twenties" and the "depressed thirties." We would insist that applied psychology has reached its majority on scheduled time and is now twenty-one years of age whether we calculate our dates from April 6, 1917, until the completion of organization of the American Association for Applied Psychology in September, 1938, or from November 11, 1918, until November 25, 1939.

In this article about applied psychology coming of age, Paterson actually listed what he considered outstanding names in the various applied fields at the time as well as listing historical characters such as William James, G. Stanley Hall, Munsterberg, Seashore, Cattell, Scott, and Thorndike. In child psychology he mentioned 11 names; in industrial and employment psychology, 18 names; in clinical psychology, 30 names; in highway safety and traffic control, three names; and in advertising, seven names. The *AAAP* is no more and now we have many divisions in the American Psychological Association with professional interests.

E. BACK TO THE *APA*

In the postwar period the *APA* was recognized as a kind of federation of 18 divisions and, with this reorganization, the *AAP* was swallowed up.

The momentum for interest in professional psychology not only remained, however, but continued at an increased tempo. In the recently published *APA* sponsored study of *America's Psychologists* (3) data is presented which clearly indicates: "Persons whose interests resemble those of the founders of the *APA* (Developmental, Experimental and Physiological, General, Personality, Quantitative, and Social) are now outnumbered two-to-one by persons whose interests are in more recently developed applications of psychology (Clinical, Counseling, Educational, School, Human Engineering, Industrial, and Personnel)" (pp. 18-19). There is also data indicating "Almost three times as many of today's *APA* members identify with clinical psychology as with experimental psychology; contrasted to the early days of the *APA*, this is a startling shift, with many effects on the nature of the field and of the *APA*" (pp. 17-18). A picture of the rapidly growing profession is described; yet the rôle of the *AAAP* in influencing growth towards a professional direction is not only not considered, but it is not even mentioned.

The Policy and Planning Board of the *APA* recommended professions for national certification of members engaged primarily in the practice of psychology as distinguished from teaching and research in 1945. In 1947 the American Board of Examiners in Professional Psychology was incorporated. The Board was authorized to award diplomas to advanced students in three areas: clinical psychology, counseling psychology, and industrial psychology. In 1952 the Council of Representatives of the *APA* adopted "Ethical Standards of Psychologists" (4). The standards and incidents behind it are available from the American Psychological Association. The long form was published in 1953, and a shorter summary (5) was published some time later. The Association also is public relations conscious and has published a public information guide. Yet, in spite of this manifested interest in professional practice and public relations, on many campuses in the United States many graduate students still get the feeling that their professors, and even their departments, not only do not favor, but make active moves to restrict their interest in courses which may be helpful in practice or expressed early interest in practice. On the other hand some of the professors complain that too many of the graduate students too often want to jump the gun before they are ready for getting into practice. An interest in professional practice definitely implies having a set of ethical standards for any organization which has some concern for its welfare and healthy growth, but from the point of view of prospectives it might be interesting to ask how did those few psychologists who practiced years ago get along without the privileges

and published codes that are available to new comers? What were used as guideposts and what kind of orientation served the purpose of an ethical code?

F. GUIDEPOSTS FOR PRIVATE PRACTICE IN 1935

If the foregoing remarks represent a fast touch and run review of psychology as a profession, particularly as seen by the leaders in its various stages of growth, it might be well now to take a look at private practice as such. The most tangible way of doing this is to take an actual person in practice, who is knowable, at the earliest possible time. In 1934 the writer moved into private practice after six years of public practice in a psychiatric child guidance set-up. Not unlike Cattell's description of psychology before 1880 as not having a damned soul there, in full time practice I was aware of the existence of only one man in the field, Dr. David Mitchell, a student of Dr. Witmer's, practicing in New York. I moved into private practice at the suggestion of a number of doctors, particularly pediatricians, who had used the public resources and felt a need for a private source of referral.

After one year of practice, at the suggestion of Dr. Achilles from the Psychological Corporation, I wrote a brief article on psychology in private practice, which may have some historical meaning for persons interested in moving into the field. The article included a consideration of community and personal needs for psychological services, illustrations of referrals and their sources, and a set of 11 guideposts or guiding principles for the practice of psychology. Of this article only the description of the situation as perceived in 1935 and the 11 self imposed guides for the practice are given. Omitted are the brief case study materials and descriptions and the listing of the sources of referrals. This appeared in 1935 and read as follows (9):

The Psychologist in Private Practice (9)

A large measure of insecurity characterizes almost every human relationship today. Frustrations, anxieties, and uncertainties are widespread. Numerous are the individuals who are confronted with crucial problems. An intelligent and sane solution of many of these calls for a knowledge of the dynamics of human nature. Large is the need for well trained individuals who can help people help themselves. The psychologist with a background of clinical experience and a first hand knowledge of factors in community organization which can be used in helping people who have difficulties in dealing with themselves and other human beings is in a strategic position to render useful services.

A psychologist thus equipped can be of service to doctors who are aware of their own limitations in training as well as time and see the

need for psychological as well as medical aid for many of their patients. He can be of help to mothers who are in need of and are aware of the need for expert help in dealing with some behavior problems of their children. He can be of aid to social agencies directed by individuals who realize the need for supplementing their work with psychological services. Some of the other sources he can cooperate with are school teachers who see in children more than subject matter experts in the making; ministers who appreciate the possibilities of using expert service in helping some of the members of their congregations who come to them for help in their very personal problems; and business organizations directed by individuals who appreciate the significance of the human factor in industry and business.

In his work with practical problems it is well for the psychologist to be fully aware of the limitations as well as the possibilities of his methods for measuring and investigating problems of behavior and personality. And in the light of that awareness it is advisable for him to set up cooperative relationships with individuals and agencies which are relevant for a particular task. Because many psychologists in their training have learned much about the abilities of men and the changing of human nature through habit training, they at times tend to neglect other ways for studying and changing behavior. The psychologist in practice, therefore, should be doubly careful to consider the physical development of an individual in evaluating his personality organization and to consider situational factors in planning a program for changing it.

In this brief article it will be impossible to discuss adequately what the writer considers an intelligent plan of action for the psychologist in private practice. As a substitute, an attempt will be made in the following paragraphs to illustrate some of these considerations through fragments from case studies and comments about sources referred, methods used and cooperative relationships instigated or responded to, and in the light of experiences of this nature to list a set of suggestions for practice. (Illustrative case studies omitted.)

In the light of experiences with cases of the foregoing nature the writer suggests the advisability of psychologists in practice keeping in mind that:

1. His interest is in the total personality of the individual client.
2. His level of interest is a working selection from the humanistic interest of the parent in his child and the objective interest of the laboratory psychologist in his research.
3. Characteristically causation is multiple not single; hence the need for a many sided study.
4. A many sided approach does not mean dealing with intangibles. Emotional and personality factors as well as physical and social factors are susceptible to critical evaluation if not reliable measurement.
5. The usefulness of tests is in the insights they yield about the personality under investigation.

6. A sense of relevance is often more important than a ritualistic "comprehensive" approach in testing or social history taking.

7. Integrated work often implies the need for coöperation with medical and other experts. That is, integration often means teamwork, not muddling through all aspects.

8. The facts of learning as discussed in educational psychology texts can be applied in practice. In many problems they do not suffice.

9. Of equal importance for the psychologist in practice are the facts of social learning as well as the mechanisms of mental adjustments called dynamisms by Dr. Healy.

10. Individual integrity is always related to, and at times dependent on, family integrity as well as neighborhood organization.

11. The need for the psychologist to grow with his client and permit the client to outgrow his need for the psychologist.

G. PSYCHOLOGICAL PRACTICE

One question asked by people who are interested in moving into private practice or in improving private practice is what kind of work is one confronted with? Some of the questions asked overlap with those asked by Vernon (20). What should the fees be? What kind of people come? Who refers them? How long does the usual treatment last? There is an interest in questions of this kind as manifested by the large attendance at *APA* meetings concerning private practice. There are, however, some facts available in published form which are not well enough known.

In 1945 Lee Steiner wrote a little book based on her own exploratory researching about where people take their mental troubles (14). She concerned herself mostly with relatively uninformed people. In getting this information she played the rôle of a patient, sponsor, or correspondent. By playing these rôles she was able to get first hand experience with the array of "talent" in the psychological "underworld." With literary license she reports that "everyone and anyone came." She reports:

For the most part, they were young people who were loaded down with ambitions they could not fulfill, unmarried people in their thirties or forties who were having disturbing love affairs, or those who were disturbed because they had no love affairs, mentally retarded individuals who could not make the grade either socially or vocationally, and people who had troubles with in-laws or relatives. Some drug addicts, shop-lifters, and students on the verge of suicide also came. Most of them were shopping around and had already visited one of the several "psychologists" listed in the telephone directory. Mail-order business she also received. These people need direction and guidance in the selection of more legitimate as well as adequate help that is furnished by "agencies" and persons described by Steiner. In this task psychiatrists and

psychologists through participation in community mental hygiene activities are in a position to help (10, p. 614).

To explore the problem of where relatively more informed people take their problems—people who can afford to pay, the kind of problems they come with, and who refers them—the writer made a study and reported his findings in an article included in Fryer and Henry's *Handbook of Applied Psychology* (10). In this study comparisons are made over the same one-year period between the psychological practice in St. Louis and the psychoanalytic practice reported by Dr. Ginsburg in New York (8). There are distinct

TABLE 1
DIFFERENCES IN REFERRALS IN PSYCHIATRIC AND PSYCHOLOGICAL PRACTICE

	Psychiatrist	Psychologist
Time consuming work	6 to 9 intensive cases	3 industrial organizations
New patients	96	120
Single occasions	71	14 (11.7%)
Follow-up	Remainder 2 to 5 visits before disposition	55 (45.8%)
Referral sources	Colleagues mostly	Clients 32%
	Social agencies 5	Former clients 28%
	Veterans' service 2	Agency-educational or social 16%
	Old patients 11	Self 9%
	Lawyers 4	Directory 8%
		Doctors 7%

differences. It might be of some value to report the information concerning differences in referrals in the two settings (Table 1).

A study of the problems and the sources of the referral of individuals who came to a psychiatrist and those who came to a psychologist shows distinct differences. Whereas the majority of the cases reported by the psychiatrist were either psychotic or psychoneurotic, more than 90 per cent of all the individuals who came to a psychologist in private practice were more often relatively normal people in relatively normal situations. Much more often were the individuals who came to a psychologist's office involved with other people, who also could be reeducated (10, p. 618).

H. PRESENT ISSUES AND VALUES

Even this brief description of experiences suggests differences in time and the range of possible attitudes and values on the part of psychologists in clinical practice and in industrial work as compared with most psychologists on the campus. In the *Dialogues of Whitehead* (21) there is a poem credited to Lady Margaret Hall which has some relevance here:

If all good people were clever
And those that are clever were good,
This world would be nicer than ever
We dreamed that it possibly could.

But it seems as though seldom if ever
Do the two hit it off as they should,
The good are so harsh to the clever,
The clever so rude to the good.

If all psychologists were equally clever, and equally clever for all purposes, as well as equally good in the ethical sense, perhaps this session would be completely unnecessary. But there are distinctive and marked differences even among psychologists in almost every respect. Psychologists are not equally good, not equally bright. They differ in shrewdness, in statistical sense, in knowledge. They differ in clinical insights. They differ in the sense of attitudes and values in political, economic, and philosophical considerations.

Some of the issues worth considering are the following:

1. *Privileges vs. Responsibilities.* National certification of experienced professionals is now provided for by way of the *ABEP* in three areas of specialization. An increasing number of states also have provisions for state certification. By these and related provisions, psychologists are given privileges which they previously did not have. The question has been justifiably asked whether the privileges being handed out are sufficiently related to acceptance of professional responsibility by the people who are receiving them. To what extent are the privileges, as now given, robbing, particularly less experienced and less trained people of a challenge to growth and maturity and acceptance of responsibility? Maternal over-protectiveness is not the best way of developing courage and integrity in children; giving relatively untrained young psychologists in practice guaranteed privileges is a form of over-protection unless they have had the kind of experience as well as training which makes them accept the challenge of self responsibility.

2. *Codes vs. Motives.* Realizing the need for ethical standards, the *APA* has in published form prescribed standards for use. Many contributions suggesting codes were made while the topic of ethical standards was kept alive. Of the many which have come to the attention of the writer, the most arbitrary and rigid one is the one suggested by Sutich (16). He offered a series of codes or a list of duties to be fulfilled prior to the establishment of the relationship with the client. Illustrative duties from his list include:

a. It is the duty of the psychologist to make a clear explanation of the

nature of the democratic consulting relationship to the client before its establishment.

b. It is the duty of the psychologist to obtain explicit or implied approval or acceptance of the democratic consulting relationship, after he has described it to the client, and prior to its establishment.

c. It is the duty of the psychologist to inform the client, prior to the establishment of the relationship, that he cannot guarantee either complete or partial psychological readjustment or reorientation or any other result through coöperative analysis.

A rapid reading of such duties will make anyone who is at all realistic and understanding ask such questions as: What is the motivation for such lists? What purpose are they supposed to serve? Are they supposed to protect the client from receiving unprofessional services or being taken advantage of in any one way? Or are they more motivated by a feeling of need for untrained psychologists to protect themselves from getting in trouble with clients? In an actual clinical work situation, for example, if a potential suicide comes in should he, following the suggested code, be advised that the first need is for establishing a democratic consulting relationship before any work is attempted? Or should he be listened to and be given the feeling of desire to understand as well as the beginnings of understanding so he encourages himself to want the help he came to get or, at times, was sent to get? Or if a very depressed person comes in and expresses persistent worries that keep him feeling low, should he too be advised that the duty of a psychologist is to inform him prior to the establishment of a relationship that he cannot guarantee either complete or psychological adjustment coöperative results through analysis? Or should he be treated as a person who is in need of help, who came for help, and who is desirous of help and who begins to get a feeling of being understood from being listened to as the beginnings of a therapeutic process? Is a set of rituals in the form of a list of duties intended to safeguard the professional or proposed to really help the client?

3. *Fees for profit vs. fees for professionally acceptable service.* A number of cases have been reported which suggest that persons who pay profit more from therapy than those who don't. By paying they have something at stake, a motive for getting well because they want to get their money's worth. In the contemporary American scene psychologists, as well as psychiatrists, disregard the majority of the population's needs when they charge the highest possible prices. By so doing they cater to the rich, who can afford to pay these prices and who can also afford to prolong therapy and thus make it possible for the practitioner to get more than his share of

money for work done. How about the middle classes who can't afford to pay these high prices? Most of these people who have a pride in wanting to pay but can't afford to pay the high prices also have too much pride to want to take services from social agencies without cost. The majority of people, therefore, are thus robbed of services they need because lack of funds prevents them from getting it the way they would like, by paying, or they are possessed by pride which keeps them from wanting to go to social agencies. The question is, of course, if professional services are supposed to satisfy community needs, should there not be provisions made for the middle classes as far as fees are concerned as well as for the rich and poor?

4. *Time arrangement for client vs. convenience of psychologist.* In the arrangement of time the usual practice is for mental hygiene specialists who charge fees to have hours between nine and five. These are the exact hours when the working man cannot come in. Only people who are their own bosses or those who can arrange their own time, or people who are rich enough or have help enough, can readily make time at the hours usually available. For people who are not in that fortunate position it would be easier for them not to have to excuse themselves before a boss or lose a day's pay if they could go after working hours. This usually means evening hours. Evening hours are sometimes available in outpatient clinic services, but rarely, if ever, in private practice. Again, community responsibility on the part of a professional would imply being available at hours possible for the client and not at hours that may be convenient for the psychologist in practice, regardless of how inconvenient and impossible they may be for the client.

5. *Overdependence vs. healthy attachment.* Listening to some relatively untrained inexperienced professional psychologists one would get the impression that they have some form of magic in their personalities with which they mesmerize their clients on the first visit. It is a fact that many clients get an overattachment for the psychologist on the first visit which may lead them to look for dependence to him as a source in which they have confidence. This is not a healthy road for maturing a client when the relationship built up is used too consistently. Unnecessary prolongation of treatment then results. Dynamics directed towards the fullest and healthiest style of self management for the client can be used to the advantage of the client's outgrowing the need for a psychologist at the earliest possible time without a loss of integrity or confidence. How to build a relationship with a client that moves in the direction of outgrowing the need of the psychologist and learning the ability to depend on himself with confidence is an important

phase of therapeutic direction. The important thing, too, of course, is to make sure that the person who is being educated to mature and grow to manage himself does so with a full enough understanding to have a survival value without professional help. To brag about a dependent personality not being able to get along without the psychologist he has been going to for a long time is nothing that represents a practice that an honest profession would approve.

6. *Diversity vs. uniformity in training.* In the Boulder Conference of 1949 on graduate education in clinical psychology, the discussion of diversity versus uniformity led to the conclusion that training programs for clinical psychologists must reflect the changing needs of society, as well as the theoretical and technical changes taking place within the profession of psychology and its related fields. It was agreed "... in view of the wide gaps in our present knowledge, the validation of our working assumptions is a task of the utmost importance. In addition to research carried out by individuals, group or coöperative research would help in arriving more quickly at answers to pressing problems of human welfare. In order to keep the profession sensitive to changes in society and in psychology, diversified university training programs should be encouraged although a basic core of general and clinical psychology will be necessary to provide a certain amount of uniform background" (17, p. 33). There is nothing in the foregoing statement that can be criticized except that it is rather vague and intangible. More specific questions should be: What kind of work will the person in private practice be confronted with? What kind of training, therefore, should he have so that he can feel well equipped to do the work he will be called on to do? Practice in clinical psychology has improved substantially in the last few years, but very little, if any of it, is slanted in the direction of preparation for private practice. One thing seems clear, whatever need there is for re-evaluation should include also the addition of a more specific kind of training that gives the graduate student an opportunity to learn what he will be called upon to do in settings resembling those that he will work in. Veterans Administration practice and hospital training are very relevant but they are not enough because a client coming to a *VA* or a hospital definitely does not come with the same attitude or the same purposes as do the people who come to the offices in private practice. In private practice there is the need for life going on at home and work while going for help, which calls for special considerations. The problem of interdependence with other professions in private practice also has its own unique characteristics. Practicing in an office associated with a group of doctors is different from prac-

ticing in one's own office and, again, may call for some differentiations in preparation which are typically not provided for in universities as they exist. An appraisal of resources would make it possible to develop such facilities which, at the present time, are neglected.

7. *Internship v. work experience.* There are some psychologists who are consistent in arguing against the use of internships, particularly in industry, Uhrbrock (19) has consistently opposed internships. Work experience in an honest-to-God industrial setting, however, can be made available for use in the training program. Whether this be called an internship or not, is not important. What is important is that one who works in industry obtains experience in the kind of settings in which he may more likely work, dealing with the kind of problems he will be confronted with when he is on his own. Potential resources of this nature can be made available if effectively explored.⁴

In the Boulder Conference, clinical psychology is described as being more client oriented than is industrial. In their wisdom the members of the Conference say: "As a consequence the clinical psychologist who works in the industrial field is frequently subjected to conflicts between his feelings of responsibility to the individual employee and his loyalty to the organization employing him. These conflicts are no different from those felt by any clinical psychologist who has some administrative responsibility or who works in a somewhat restrictive framework, but they are apt to be intensified in the industrial situation" (17, p. 156). What the members of the Conference fail to realize is that what they are really saying is that in our present graduate course set-up, no provisions are made for psychologists getting enough of a background in economics, labor problems, and industrial organization as deemed necessary by business groups as well as by psychologists. Given that kind of an enriched perspective, a person with clinical experience as well as with enough knowledge of industrial organization will have some problems that are distinctly different but also manageable. What conflicts of loyalties he develops will more often than not be of his own making because of a lack of perception of the nature of the people he deals with for the problems he is seeking to solve.

8. *Self-sufficiency vs. interdependence in practice.* In private practice there are some people who think that they have to have a set-up where they can serve and satisfy all psychological service needs. Generally speak-

⁴On a small scale resources of this nature are now available for graduate students at Washington University by arrangement with the Human Relations Research Foundation.

ing, that is neither the possible, nor the desirable thing to do. People who survive in private practice and grow, typically have more interdependent relationships with doctors, with educational agencies, with social agencies, and other human institutions interested in human welfare. This implies not only professional relations for public relations purposes, but also is an admittance that every human being has limitations. A sense of limitation will make it more readily possible for a psychologist to be most helpful to his client by referring him to sources that specialize in certain kinds of helping needs more than he can render himself. A psychologist is in a position differentially to select or supplement with persons or facilities equipped to deal with their specialty rather than be a one and only source of support in a pseudo self-sufficient manner.

9. *Understanding and management vs. diagnosis and treatment.* A study of the kind of problems which confront a psychologist in practice suggests that there is altogether too much emphasis on ritualistic diagnosis and treatment and that the concepts themselves, although useful in medical practice, are sometimes a handicap rather than a help as an intellectual reference point for dealing with human problems as they appear in the psychological services. Much more to the point and more honest would be to think in terms of understanding and management instead of diagnosis and treatment. The style of understanding usually predetermines the likely style of management. This is so in breadth as well as depth of understanding. A person who, for example, conceives of mental disease as being brought about by being possessed by the devil has relatively few types of courses of action open to him as far as management is concerned. His treatment is limited to ways of getting rid of devils, ranging all the way from near murder to prayer. Similarly, if a person has a wider perspective in the light of which he studies and interprets human problems, his understanding will be fuller and his management, therefore, more realistic and adequate. The concept of understanding and management is not only an advantage in actual private practice, but is also a conceptual framework that readily enough can be carried into other situations such as industry.

In the present day we have to consider the human being in all of his human surroundings, his economic realities, his political realities, his social realities, as well as his family realities. Approaching this problem in terms of the fullest possible understanding for the most effective possible management is the only road that makes for the kind of understanding which makes further understanding more possible both to the professional and to his client. For so doing a historical perspective is an important ingredient.

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THE HUMASCOPE: A MODIFIED STEREOSCOPE*

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A. INTRODUCTION

The stereoscope has been employed in the investigation of many diverse phenomena involving binocular vision. It has been used in the study of three-dimensional space perception, color interaction, rivalry effects, and neural visual mechanisms. Recently Engel (3) demonstrated that learning also plays a rôle in binocular resolution. This finding suggests that the stereoscope may be used to study problems in the areas of perception and personality and social perception.

The utilization of the stereoscope in this manner warrants some comment. The visual system combines the input from each eye into a single percept. In normal binocular perception the inputs are fairly similar. The differences that obtain are introduced by the different vantage points of each of the eyes. The stereoscopic method of investigation takes advantage of the fact that two percepts introduced monocularly and simultaneously are resolved centrally into a single percept. This central resolution requires that the elements which form the final percept be selected and organized in some fashion by the perceiver.

Engel (2), in a progress report submitted by Cantril and Kilpatrick, reported some preliminary observations on the effect of viewing pictures of two different faces stereoscopically. He reported that the composite picture is described as "more pleasant looking" than either of the individual pictures. In an attempt to verify and expand this finding a stereoscope was conceived of which utilized actual faces, rather than pictures; hence the name Humascope.

It is felt that such a stereoscope offers several advantages over the Engel stereoscope, i.e., greater size of stimulus objects, absence of distortion which is introduced by the use of prismatic lenses, and greater manipulability of the stimuli. In addition, this new stereoscope by virtue of its size and design can handle large pictures and real objects. It can be used with 2 x 2 slide

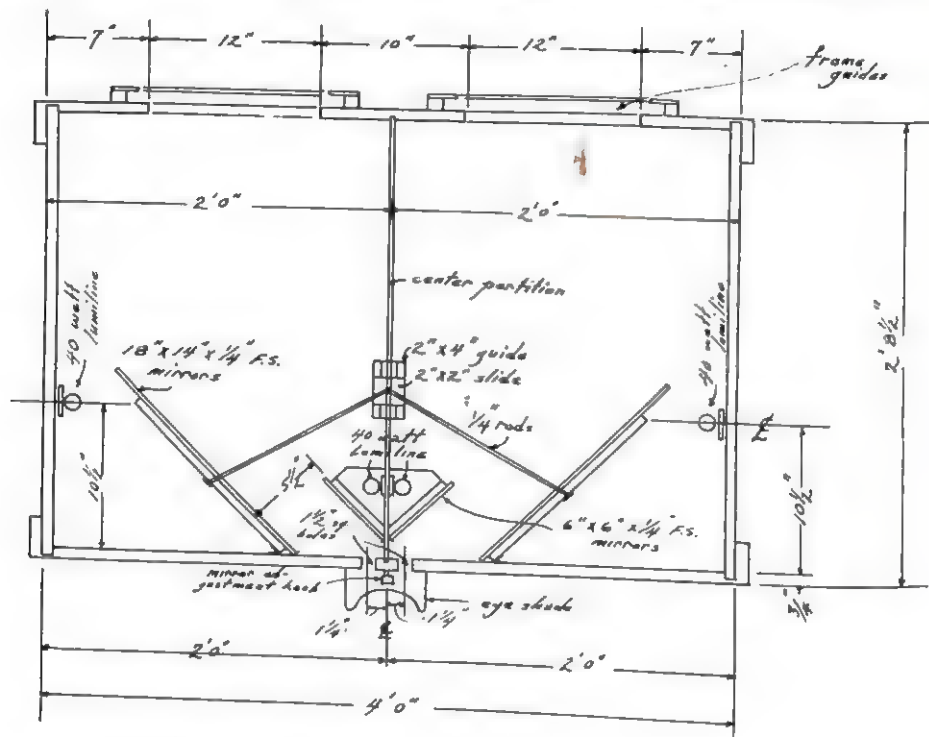
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projectors or movie projectors and permits presentation of sequences to each eye simultaneously.

B. APPARATUS

The Humascope (Figure 1) utilizes two sets of front surfaced highly polished optical mirrors to produce stereoscopic presentation of the stimuli. The



NOTES

- All mirrors centered vertically on 1 1/2" square viewing holes.
- All 40W Lumiline fixtures centered vertically on 1 1/2" square viewing holes.

FIGURE 1
CONSTRUCTION DETAILS

mirrors are mounted in a large cabinet which has on its face an eye-shade containing two viewing channels spaced $2\frac{1}{2}$ " apart. There is also an adjustment knob on the face of the cabinet which allows the viewer to adjust the outer mirrors. The mirrors are mounted in the following manner: the smaller mirror of each set is fixed at an angle of 45° in relation to a partition joining the frontal wall at the center of the viewing area and set per-

pendicular to this wall. The two mirrors form an angle of 90° in relation to one another. To the right and left of these center mirrors are mounted the outer adjustable mirrors which are placed so that when they are adjusted parallel to the center mirrors there is a distance of $5\frac{1}{2}$ " (measuring parallel to the front face) between the center and outer mirrors. Adjustable chin rests are set at points $32\frac{1}{2}$ " back from the face, 13" from each side, and 10" from the base. The chin rests are constructed so as to allow for an adjustment of 2" either up or down. Directly in front of these chin rests are mounted two fusion targets. In each of the fusion targets are two eye slits. The eye slits serve a double purpose. Viewed from the perceiver's side they offer the means for adjusting the humascope to achieve fusion. This is done by turning the mirror adjustment knob until only one set of eye slits is seen. Viewed from the side of the perceived they offer the means for adjusting the head in the up and down dimensions and for correction of head tilt. This is done in the following manner: the perceived (the person at whom the perceiver is looking) looks straight ahead and adjusts the chin rest until he sees the viewing channel reflected in the mirror in front of him whereupon he closes one eye at a time. This assures that his head is not tilted since such a tilt would produce a discrepancy in the amount of the viewing channel which he sees.

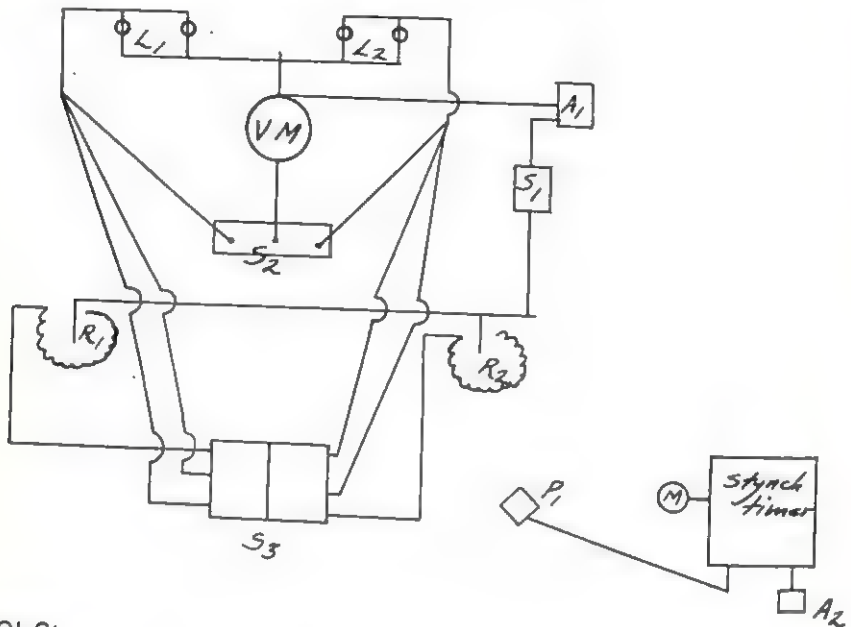
In order to insure even lighting two pairs of 40-watt lumiline fixtures are used. One light of each pair is placed at each side of the cabinet between the adjustable mirror and the end wall. The other of the pair is located in the "vee" which is formed by the two central mirrors on each side of the central dividing partition. In this way even lighting is produced and there is a minimum of stray light hitting the mirrors. In addition, by the use of rheostats and timers (Figure 2) the lighting in each compartment may be separately controlled.

The rear panel is designed so that the head rests may be replaced by pictures, color wheels, lights, and a ground glass screen for projection purposes. When the ground glass screen is slid into place two slide projectors, or movie projectors, mounted about five feet behind the screens allow for presentation of 2×2 slides or movie films.

C. RESEARCH POSSIBILITIES

One might further investigate the preliminary findings already discussed that two faces viewed stereoscopically will fuse to form a percept which is described as "more pleasant looking" than either percept viewed independently. It may be possible to determine which features are seen in fusion

by different subjects and to relate these perceptual preferences to external criteria. Such information would be of interest in the study of social values, aesthetics, formation of assumptive form world, etc.



SYMBOLS:

- L_1, L_2 - 2 40 watt Lumiline
- VM - 0-150 V, AC Voltmeter
- R_1, R_2 - 100W, 20ohm Potentiometer
- S_1 - SPST Switch
- S_2 - SPDT Neutral Center Switch
- S_3 - 6pole 3 position Lever Switch
- A_1, A_2 - motor base
- M - Momentary Switch

Note: power supply to A_1 eliminates timer.
power supply to A_2 with P_1 to A_1
places timer in circuit.

FIGURE 2
SCHEMATIC WIRING DIAGRAM

The effect of varying degrees of emotional tone related to pictures or word sets might also be investigated. A preliminary investigation (1) suggests that words having greater negative valence tend to be less readily seen than neu-

tral words. Pictures with aggressive, sexual, or nutrient connotations might be opposed to pictures having more neutral value. In this way one might explore experimentally some of the hypotheses formulated about perceptual defense and perceptual vigilance.

Studies matching psychotic, neurotic, and normal populations on such variables as rate of alternation, amount of fusion, etc., might also be undertaken. Such studies would help to make explicit differences in perceptual functioning in these several groups.

Another set of problems open to investigation involves object choice and its relation to personality variables. In a pilot study it was observed that younger children are more likely to perceive the mother when both parents are presented.

The possibility exists also for the study of the effects of viewing two different motion pictures out of phase. This could be done by presenting one motion picture to each eye at a frequency just above the fusion threshold. A synchronization mechanism would be needed so that the picture to the right eye would be in its on phase when the picture to the left eye is in its off phase, and vice versa. This technique would allow for investigation of the capacity of the organism to resolve rapidly moving visual input and would give some indication of how such input is distorted.

D. SUMMARY

A method is described for investigating problems in the areas of perception and personality and social perception. A rationale is offered for the use of this method and detailed description of the apparatus is included. In the final section suggestions are made for research using this technique.

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THE CONCEPT OF "HYPNOSIS"*

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A. INTRODUCTION

Discussions of hypnosis are still encumbered with static and mentalistic concepts. In a recent symposium (52), for example, various authors viewed hypnosis as "trance," as a "state of dissociation," as an "unconscious level of awareness," and as a "preconscious" and "subconscious" state. Hypnosis will retain the status of an "unexplained" phenomenon as long as it is conceptualized in this manner. *Hypnosis is not a "state" of any kind.* Furthermore, it is not an example of "subconscious motivation" or "unconscious awareness," it is not a static entity called "trance" and it is not the result of "suggestion." The term "hypnosis" is a *descriptive abstraction* referring to a number of interrelated and overlapping processes.

For analytical purposes, I shall first discuss the processes of hypnosis as if they are fixed at a particular point in time and space, i.e., I shall analyze them as "factors" in the behavior of the "good" hypnotic subject. In a later section, I shall discuss the same processes with the operator, i.e., "the hypnotist," as the frame of reference. Finally, I shall indicate how we can begin to understand the "complex" phenomena of hypnosis—"anti-social" behavior, analgesia, psychosomatic alterations, "post-hypnotic suggestion," etc.—as functions of these processes.

B. THE HYPNOTIC PROCESSES

1. *The Subject as the Frame of Reference*

The locus of hypnosis is not "in" the subject. Hypnosis is primarily a transactional process between the subject and the operator. To analyze this transactional process, however, we must choose some point of reference and we must subdivide it into separate processes. If we begin by taking *the subject* as the frame of reference we can tentatively separate this transactional process into three interrelated and overlapping processes:

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(a). The process of becoming concerned only with the words of the operator and with those aspects of his self and his surroundings to which the operator specifically directs his (the subject's) attention.

(b). The process of becoming ready and willing—becoming “set”—to carry out the instructions of the operator.

(c). The process of coming to believe that the operator has the “power” or “ability” to “make things happen” and the concomitant process of beginning to “literally think as the operator wants him to think” (1).

2. *The Process of “Detachment”*

Bernheim, Forel, Bramwell, and other early investigators noticed that the “good” subject² becomes concerned only with the words of the hypnotist and those aspects of his self and his surroundings to which the hypnotist directs his attention. Recent investigators also note this relative “detachment.” For example, Christenson states: “Unless the agent calls them to attention, a number of environmental stimuli seem to be shut off, for example, noises in general, and awareness of or reaction to the presence of other persons not involved in the process” (20, p. 39). Likewise, Arnold writes: “In hypnosis (as in sleep) sensitivity to outside stimulation (apart from stimuli by the hypnotist) is decreased considerably” (1, p. 117).

The previously neglected “introspective” approach to hypnosis also indicates that the good hypnotic subject becomes concerned only with those aspects of his self and his surroundings to which the hypnotist directs his attention. For example, one week after completing a series of experiments (6, 7, 9) the writer telephoned all of the subjects who had participated and asked them “to state for a scientific journal as objectively and as scientifically as you can what the difference is between the way you feel when you are awake and when you are hypnotized.” All of the somnambulistic subjects (and none of the “poor” subjects) stated, directly or indirectly, that when “hypnotized” they were less “concerned about things” and less aware of themselves and their surroundings. A typical comment by one such sub-

²In this essay I am concerned only with the behavior of the “good” or “somnambulistic” hypnotic subject, i.e., the subject who experiences many or all of the classical hypnotic phenomena. The theories of White (75), Sarbin (69), and Arnold (1), are applicable to the behavior of the “poor” or “fail” subject who is “striving to behave like a hypnotized person” (White), who is “striving to take the rôle of the hypnotized person” (Sarbin), or who is “vividly imagining the situation as the hypnotist describes it” (Arnold). However, these theories do not explain what is most in need of explanation: the behavior of the “good” subject who undergoes surgery with hypnotic “analgesia,” who “sees” the correct negative after-images of hallucinated colors, who experiences “age-regression,” who carries out complex “post-hypnotic suggestions,” etc.

ject was: "The reason why hypnosis is so pleasant is because everything is nice and peaceful and I don't really think about anything unless the hypnotist tells me to think about something."

In fact, if there is any characteristic that good hypnotic subjects have in common, it is this: long before they were formally "hypnotized," this type of behavior—becoming relatively detached and unconcerned about surrounding stimuli—was an integral part of their daily life. Young (76), for example, found that one or more of the following characteristics showed themselves in all of his best subjects *before* they were "hypnotized": "Deep abstraction, reverie amounting almost to ecstasy, putting oneself to sleep at will, actually hypnotizing one's self." Similarly, the writer found that the 10 somnambulistic subjects who participated in the experiments mentioned above (6, 7, 9) had been able since childhood to concentrate on their work or studies by "blocking-out" environmental stimuli. With very rare exceptions, they could also go to sleep easily and quickly at any time—day or night. A typical statement was: "I can go to sleep in the middle of a conversation. If I'm interested in something I can concentrate even if someone is yelling. If I'm not interested, I usually fall asleep."³

This process of relative detachment from the environment (and the usually concomitant processes of decreased active "thinking" and increased muscular relaxation) is often conceptualized as a mysterious entity called "trance." There is no objection to using the term "trance" to describe this process *if* we remember that it is not an "entity" and that it is not "unusual." It is, in fact, a not too uncommon aspect of our daily life. An individual is reading a book when he suddenly realizes that he has no idea of what he has just been "reading." For a few moments he was "in trance"; he was not only unconcerned about the printed page, he was also not "thinking about anything" and not attending to and not perceiving his surroundings. We also experience this process of relative non-response to stimulation, this passive, relaxed, non-thinking attitude, as we become drowsy and sleepy. Leuba was justified in concluding from his extensive study of the "trance" of the yogi, the mystic, the shaman, and the hypnotic subject that: "Were it not customary to use the word trance only when the state . . . is produced under

³Except for Sarbin's finding that "somnambulism" correlates very significantly with the hysteria scale on the *MMPI* (69, p. 265), there exist, to the best of my knowledge, no other studies besides my own and Young's which have attempted to determine, what, if anything, characterizes the somnambulist. The reports in the literature on the relationship between "hypnotizability" and "personality traits" do not attempt to distinguish between somnambulistic and other hypnotic subjects. These studies find, in general, that the more friendly, sociable, cooperative individual tends to be a better subject than the introverted, insecure individual (3).

unusual or abnormal conditions, ordinary drowsy states and normal sleep would be called trances" (53).

"Trance" and "Sleep." The reification of "sleep" into a "state" which we "go into" or "come out of" has stultified the investigations of this process and has left "sleep" a mysterious and unexplained phenomenon. "Sleep" is *not* a "state" which automatically "shuts off" our awareness of surrounding stimuli. "Sleep" is an *organismic process* that can be viewed from different frames of reference. If we focus on the perceptual functions of the organism, we conceptualize sleep as a process of decreasing attention to and perception of the environment. If we focus on the musculature of the organism, this process is termed "relaxation." If we focus on the cognitive functions of the organism, this process can be conceptualized as "decreasing symbolic manipulation of the environment." These are not separable processes but different ways of viewing the same process. The work of Horton (42), Jacobson (43, 44), Max (59), and Miller (62) converges on the conclusion that increasing muscular relaxation, decreasing thought processes, and decreasing attention-perception of stimulation are intimately interrelated and separable only for conceptual purposes. "Sleep" is not a "state" superimposed upon this process: "sleep" is this total organismic process.

As the writer has pointed out elsewhere (+), the concept of "trance" refers basically to the same process as the concept of "sleep." However, the concept of "trance" is used when the process of decreasing attention to stimulation, decreasing thought processes, and increasing relaxation does not go as far as it does in "sleep" *because the subject attends to a very limited group of stimuli*. The entranced yogi, for example, is concerned only with "stimuli that have a spiritual value" (14); the *sangiang* dancer of Bali is said to be "in trance" when she pays attention only to the music and remains unconcerned and detached from all other aspects of her environment (15, 11). Similarly, we say that the hypnotic subject is "in trance" when he is concerned only with the words of the hypnotist and those aspects of his self and his surroundings to which the hypnotist specifically directs his attention. If the hypnotist does not direct the subject's attention to this or that aspect of his self or his environment, the good hypnotic subject, like the "drowsy" and "sleepy" individual, remains relatively unconcerned about his surroundings, relaxed, and not actively thinking and analyzing. If the hypnotist directs the subject's attention to various aspects of his self and his surroundings, the good hypnotic subject attends only to those aspects and remains unconcerned about other stimulations.

A recent experiment also indicates that the process termed "trance" is *one*

of the processes involved in hypnosis. In this experiment (2, 5) the writer approached 22 subjects in the middle of the night, when they were sleeping in their own rooms, and (without a preliminary "hypnotic induction procedure") gave them seven "tests of suggestibility," e.g., "your left arm is rising and coming up and up," "you are becoming very thirsty and you'll have to get up in exactly five minutes and drink water," etc. In later experiments he gave these subjects the same seven "tests of suggestibility" when they were "awake" and after a "standard hypnotic induction procedure." He found that:

(a). When the subjects were "sleeping," i.e., when they were relatively "detached" from their surroundings, they were significantly more "suggestible," i.e., they were much more ready to experience the phenomena of hypnosis, than when they were awake.

(b). There was no significant difference in the subjects' responses to the "tests of suggestibility" when they were "asleep" and when they were "hypnotized."

It seems therefore that "trance" may be one variable involved in "hypnosis." That this is not the *only* variable is evident from the sequel to this experiment.

3. *The Concept of "Set"*

Although the subjects of the above experiment were "sleeping" when the writer approached them at night, they were nevertheless ready and willing—they were "set"—to carry out his instructions. He had previously asked their permission to give them "psychological tests" in the middle of the night when they were asleep; they had willingly agreed to be tested, and they were aware, to a greater or lesser extent, that he was going to test their "suggestibility." In a later experiment he attempted, as far as possible, to exclude this factor of "set": he approached four other subjects in the middle of the night, when they were asleep in their own rooms, without previously obtaining their permission to do so. These subjects "woke up"; they did not respond to the "tests of suggestibility"; they were not "set" to obey his "suggestions." It seems, therefore, that the hypnotic subject does not remain relatively detached and unconcerned about his surroundings if he is not "set," i.e., if he is not ready and willing, to carry out the instructions of the operator.

An experiment by Eysenck and Rees (31) also indicates that both of these "variables" are involved in hypnosis. They found that drugs such as sodium amytal, which help the subject to become inattentive to his surroundings (21), are useful in the "induction of hypnosis" *if* the subject is already willing and ready to follow the instructions of the operator.

This factor of readiness and willingness, i.e., "set," has been emphasized in the recent theoretical formulations of White (75) and Sarbin (69). Subsuming this factor under the more general concept of "motivation" they see the hypnotic subject as trying to play "the rôle of the hypnotized person" (Sarbin) or as "striving to behave like a hypnotized person as this is continuously defined by the operator and understood by the subject" (White). These formulations, however, neglect the "end-result" of the hypnotic processes: the subject accepts the hypnotist's words as true statements and he "perceives" himself and his surroundings as they are defined by the hypnotist.

4. *Altering the Subject's Conceptions*

"Motivation" and "relative detachment from the environment" are not sufficient conditions for "hypnosis." An individual who is motivated to carry out instructions and who is able and willing to maintain an attitude of relative "detachment" from his surroundings is not "deeply hypnotized" unless he also believes that the hypnotist's words are true statements. In a previous communication (8) the writer presented evidence indicating that a somnambulistic subject quickly becomes a poor hypnotic subject when he is shown that he has complete control over the hypnotic situation⁴ and when he realizes that the hypnotist does not have any special "power" or "ability" to make him believe anything he does not wish to believe or make him do anything he does not wish to do.

Investigators have not failed to note that the good subject accepts the hypnotist's words as valid statements. Erickson, for example, has noted this factor in many of his reports, e.g.: "Subsequent questioning of the subject under hypnosis disclosed a persistence of an understanding of the total situation in full accord with the hypnotic suggestions and not in accord with the actual facts" (29, p. 200). The complex phenomena of hypnosis—age-regression, hallucinations, amnesia, psychosomatic alterations, etc.—have never been satisfactorily explained, however, because this factor has been relatively neglected in previous theoretical formulations.

5. *The Hypnotic Processes from the Hypnotist's Frame of Reference*

Before indicating how we can begin to understand the complex phenomena of hypnosis as functions of these interrelated processes and, more specifically, as functions of the "end-result" of these processes—the alteration in the

⁴Ronald Shor of Brandeis University has pointed out to me that he had previously trained this subject to control, in autohypnosis, which suggestions he would respond to. I was not cognizant of this fact at the time of publication of the original article (8).

subject's conception of himself and his surroundings—it would be profitable to analyze these processes with the hypnotist as our frame of reference.

From the subject's viewpoint "hypnosis" begins with the "formal induction procedure." From the operator's viewpoint "hypnosis" begins with the preliminary conversation which *precedes* this formal "induction." In this conversation the operator attempts to establish himself in the eyes of the subject as a person who is able to "hypnotize"; at the same time he attempts to "motivate" the subject by alleviating his fears and misconceptions and by describing hypnosis as something "good," "interesting," or "useful."⁵

Although there are many variations in hypnotic technique, the usual procedure is designed to help the subject become relatively unconcerned about internal and external stimulation by monotonously repeating the words "comfortable . . . relaxed . . . drowsy . . . sleepy . . . sounds are far away . . . nothing matters at all . . . etc." However, the operator may also bring the subject to the point of relative "detachment" from his self and his surroundings by focusing his attention on a very narrow range of stimulations, e.g.: "Notice the unusual sensations in your right arm. Think only of the sensations in that arm and of nothing else. Notice how the arm is becoming lighter and how it's beginning to rise and come up and up."

By including events in his induction procedure that take place as a normal reaction to the situation, the operator indirectly tries to convince the subject that "the hypnotist can make things happen" and "can make him do things that he would not ordinarily do." When the operator tells the subject to stare at a disc, or at a spot on the wall and then tells him, "Your eyes are becoming tired," the subject does not usually realize that his eyes are becoming tired as a normal reaction to the prolonged staring; he thinks the "hypnotist is making them tired." When the operator tells the subject, "You are becoming drowsy" (after subjecting him to the monotonous sound of his voice and the words "drowsy . . . so drowsy" for many minutes) the subject usually concludes that "the hypnotist is making him drowsy." Very few subjects are aware that becoming drowsy in this situation is a normal reaction to the prolonged monotonous stimulation.

The operator, therefore, attempts by his words, by the timing of his statements, and by his manipulation of the situation to guide the subject (a) to become relatively unconcerned about his self and his surroundings, (b) to become "motivated" to carry out instructions, (c) to believe that "hypnosis"

⁵This is what Orne and Shor term the "structuring of the trance induction situation which is one of the major factors determining whether the subject will enter trance" (63, 71).

or the "hypnotist" can make him behave in unusual ways, and (d) to accept the hypnotist's words as true statements of what is happening and of what is going to happen.

The operator of course adjusts his procedure to "fit" the subject. In fact, some individuals—"trained" hypnotic subjects—do not require a lengthy "induction procedure"; they are *already* "set" to enter "trance," to carry out instructions, and to accept the hypnotist's words as valid statements.

Also, the relationship between the hypnotist and the subject (and between the subject and his surroundings) is constantly varying throughout the procedure. The subject is at times more and at times less aware of his self and his surroundings; he is more or less set to carry out the hypnotist's instructions; he is more or less ready to accept the hypnotist's words as true statements. Hypnosis is far from a static "entity"; hypnosis is the interrelated, overlapping, and continually varying processes which are separable into static "factors" only for analytic purposes.

C. THE PHENOMENA OF HYPNOSIS AS FUNCTIONS OF THE HYPNOTIC PROCESSES

When these "factors" have all become operative, that is, (a) when the subject has become concerned only with the words of the operator and those aspects of his self and his surroundings to which the operator specifically directs his attention, and when, concomitantly, he has become more relaxed and not actively thinking and analyzing, and (b) when he has become "set," i.e., ready and willing, to carry out instructions, and (c) when he has come to believe that the operator has some special power or ability to make him behave in certain ways, or to make things happen in certain ways, the subject is ready to experience all of the hypnotic phenomena—analgesia, hallucinations, amnesia, age-regression, etc.—because he is ready to accept the operator's words as valid statements about himself and his surroundings and he is ready to "perceive" and conceive "reality" as the operator defines it.

We can now begin to understand why "hypnosis" and the "phenomena of hypnosis" have always seemed mysterious. It is time to stop attempting to explain hypnotic hallucinations, analgesia, amnesia, etc., as functions of a "state of consciousness" or of an "altered state of the organism" and begin analyzing these phenomena in terms of the entire transactional process which we call "hypnosis." Let us begin by making a preliminary application of these principles to the problems of "anti-social" behavior in hypnosis, hypnotic alteration of sensory-perceptual functions, "psychosomatic" alterations, and "post"-hypnotic behavior.

1. *Anti-Social Behavior*

The issue of "anti-social" behavior in hypnosis can be reformulated from this perspective. The experimental evidence indicates that a "good" subject *will* perform what an objective observer views as anti-social or dangerous acts—e.g., attempting to strangle an officer (72), throwing sulfuric or nitric acid at the experimenter (67, 77), stealing (18)—*if* the subject is first "*convinced*" that the behavior is normal and proper. (Watkin's (72) subject, for example, attempted to strangle his superior officer when he was led to believe that the officer was a Japanese spy.) Two recent extensive reviews of this problem have not failed to note that since the good subject accepts the hypnotist's words as true statements, an unscrupulous hypnotist can induce the subject to commit "anti-social" acts. Young concludes that anti-social behavior can be induced during hypnosis if we "change one's perception of the situation, one's belief about himself and others" (77, p. 393). Weitzenhoffer concludes similarly: "If the subject is made to perceive his actions as not being anti-social, he most probably can be induced to perform anti-social acts" (73, p. 206).

2. *Sensory-Perceptual Alterations*

Hypnotic alterations of sensory-perceptual functions, e.g., hypnotic "deafness," "color-blindness," and "anesthesia," are enigmatic phenomena if the human organism is viewed as a machine-like object that *must* respond to a standard input—"the stimulus"—with a standard output—"the perception of the stimulus." This conception, however, overlooks not only the phenomena of hysteria but also the countless instances in daily life when individuals do not attend and do not perceive "stimuli impinging upon their sense receptors." This viewpoint also neglects the entire range of human behavior conceptualized as "sleep" when the individual selectively pays less and less attention to, and perceives less and less of, his surroundings. It seems that the "blindness," "deafness," and "anesthesia" of the classical hysterical, the "selective deafness" of the sleeping individual, and the "color-blindness" and "analgesia" of the hypnotic subject can be subsumed under one general principle: there is no *necessary* correlation between "stimulation" and "perception"; we do not perceive unless we first *attend* to the stimulating object.

Relatively few subjects experience hypnotic "color-blindness," "deafness," or "analgesia." To experience these phenomena the subject must not only be relatively inattentive to his surroundings and highly "motivated" to be a good hypnotic subject, he must also be "*convinced*" that he cannot possibly perceive these stimuli. For example, Erickson was able to induce hypnotic "deaf-

ness" in only six out of more than 100 trained hypnotic subjects (25, 26). After the "induction of a deep trance, followed by a deep hypnotic stupor and succeeded in turn by a profound somnambulistic state,"⁶ he attempted to convince these motivated subjects that they were totally deaf by a long series of emphatic statements that included "realization that deafness *could* be achieved, that it *would* be achieved . . . and that it was an *impending actuality* of the moment." When these six subjects were "*convinced*" that they were deaf, they did not "perceive" acoustic stimuli as indicated by (a) verbal report that "they could not hear," (b) loss of habitual responses to auditory stimuli, (c) absence of all startle reflexes, (d) inability to establish a new conditioned response to a sound stimulus, and (d) loss of previously formed conditioned responses to sound stimuli.⁷

Hypnotic "Analgesia." A long series of reports leave no doubt that pain associated with a wide variety of conditions can be totally eradicated by hypnotic procedures. Some of the most recent reports, for example, include the use of hypnotically-induced analgesia to eradicate the severe pain of terminal cancer (19), amputation (68), fatal burns (22), bilateral mammaplasty (58), and Cesarean section and hysterectomy (48).

Hypnotic analgesia however is not an isolated phenomenon. Many other studies also contradict the assumption that the human organism *must* respond to a "noxious stimulus" with a "pain response." The writer suggests that an indirect approach to hypnotic analgesia will prove profitable: we should try to find the common denominator of the studies which indicate that there is no necessary relationship between "noxious stimulation" and the "perception of pain." For example:

1. A number of individuals who appear to be almost completely insensitive to pain have been studied by careful laboratory procedures (17, 34, 49, 56, 60). Although these individuals do not appear to have any neurological defects, they rarely give the usual behavioral and physiological responses to such noxious stimulations as fractured legs, bullet wounds, and teeth extractions. When they were subjected, in the laboratory, to such nor-

⁶The concepts of "hypnotic depth" and "stages of hypnosis" are ambiguous and misleading. Some investigators use these concepts to refer to the subject's relative detachment from his surroundings; others use them to refer to the subject's willingness to carry out instructions or to accept the operator's words as true statements about himself and his surroundings. A more basic objection to the use of these concepts, however, is that they imply that hypnosis is some kind of a static "entity" which we can go "deeper into" and from which we can "come out of."

⁷In another similar experiment (27) Erickson carefully manipulated the situation to convince six highly motivated subjects that they were color-blind. His report indicates that when these subjects were "convinced" that they were color-blind, they responded to the Ishihara test as if they did not "perceive" the color-stimuli.

mally very painful procedures as (a) muscles ischemia, (b) esophageal distention, (c) intravenous injection of 0.2 cc. of 1:1000 histamine phosphate, and (d) immersion of hands in ice cold water, there was an absence of normally expected physiological responses such as increased heart rate, blood pressure, and respiration (60), they disclaimed discomfort, and they showed no wincing, sweating, withdrawal, or tremor (49). Ford and Wilkins (34) concluded from their study of three such individuals that: "These patients do not have . . . loss of any type of sensitivity . . . they are merely *indifferent to pain.*"

2. Patients have been relieved of the severe and intractable pain of carcinoma, tabes dorsalis, causalgia, atypical facial neuralgia, etc., by prefrontal lobotomy (35, 32, 47). Although there is no necessary relationship between prefrontal lobotomy and altered behavior (39, 50), some studies indicate that the lobotomized patient is relieved of intractable pain when he becomes "indifferent" and does not "attend" to the noxious stimulation (35; 37, p. 113; 38, p. 316; 45, 50, 61).

3. Other studies—e.g., "phantom limb pain" (30, 46), "natural childbirth" (65), mitigation of the pain response after isolation (40), lack of pain response in severely wounded soldiers (12), relief of pain by placebos (13)—also indicate that when an individual does not "attend" to the noxious stimulation, the expected "pain response" decreases or disappears.

4. Studies which report a reduction or disappearance of response to noxious stimulation during "relaxation" (62, 44) are also related to the phenomenon of "hypnotic analgesia." (Clinical reports (23, 57, 64, 66) seem to agree that the hypnotic subject remains "relaxed" when he is "convinced" that his body—or body part—is insensitive to pain.)⁸

Livingston (54) summarizes these investigations as follows: "Pain is a perception, and as such is subject to the influence of associated ideas, apperceptions, and fears. The impulses which subserve it are not pain, but are merely a part of its underlying and alterable physical mechanisms."

An over-all view of these studies suggests that we can increase our understanding of "hypnotic analgesia"—and any other type of "non-organic analgesia"—by testing this hypothesis: the decrease or disappearance of response to noxious stimulation (during "hypnotic analgesia") is one aspect of a total

⁸The psychogalvanic response to noxious stimulation often decreases or disappears during hypnotic analgesia (38, p. 283; 70, 74). Since the psychogalvanic response seems to be one aspect of a total organismic response to a stimulation "interpreted" as "threatening" (36), its decrease or disappearance during hypnotic analgesia may indicate that the hypnotic subject does not "perceive" the noxious stimulus as "threatening" or "pain-producing."

organismic response which includes the subject's "*conviction*" that he is insensitive to pain and the concomitant and interrelated processes of decreasing attention to stimulation (including the noxious stimulation), decreasing symbolizations, and increasing muscular relaxation.

3. "*Psychosomatic*" Alterations

In another communication (10) the writer has summarized the evidence indicating that we can approach an understanding of the "psychosomatic alterations" which can be brought about by hypnotic processes—control of dysmenorrhea, reduction of warts, alterations in gastric secretions, etc.—if we hypothesize that the hypnotic subject is responding organismically to the stimulus-situation as he *himself* "perceives" it and *not as an objective observer* "perceives" it. (For example, a number of reports indicate that the bile secretions, and the quantity, acidity, and *specific* enzymatic content of the gastric secretions are the same when the subject "*believes*" he is eating a certain (hallucinated) food and when he really is eating this food (16, 24, 41, 51, 55).) We should investigate the limits of this hypothesis. Which individuals respond in this way? What is their reactional biography to the specific stimulus-situation? Which physiological functions can be influenced in this manner?

4. "*Post*"-Hypnotic Behavior

The hypnotic processes do not necessarily terminate when the operator tells the subject to "wake up." The same factors operative in hypnotic behavior also operate in "post"-hypnotic behavior. In experiments reported elsewhere (7) the writer found that when somnambulistic subjects are told to "wake up," after they are given "post-hypnotic suggestions," they behave as follows:

(a). They open their eyes and become *relatively* more aware of their surroundings.

(b). They remain set to carry out any additional "suggestions" the hypnotist may give them throughout the entire "post"-hypnotic period—from the moment they are told to "wake up" until they are convinced that the experiment is over.⁹

⁹Fisher concluded from an earlier experiment (33) that subjects follow "post-hypnotic suggestions" as long as they believe the experiment is still in progress. The writer confirmed this finding by the following experiment: he gave the subjects a series of "suggestions" such as, "You cannot move your left foot," "Your right arm is rising," etc., immediately after they "awakened," when they were carrying out the "post-hypnotic suggestions," and immediately after carrying out the "post-hypnotic suggestions." They obeyed these "suggestions" and they continued obeying additional "suggestions" until they were convinced that the "experiment was over." They became convinced that the experiment was over only when the writer

(c). When the "post-hypnotic suggestion" is a "simple" one that is not incongruous with normal behavior, they carry it out without "going deeper into trance"—without becoming relatively more inattentive to and unconcerned about their selves and their surroundings. However, when the "post-hypnotic suggestion" is "complex" and incongruous with normal behavior, they are ready to go "deeper into trance" to carry it out properly.¹⁰

Whether the subjects are or are not "given amnesia" for the "post-hypnotic suggestions" is unimportant; "amnesic" and "non-amnesic" subjects carry out the "suggestions" in essentially the same way.¹¹

The hypnotic process, therefore, does not necessarily terminate when the hypnotist tells the subject to "wake up." If the command to "wake up" is preceded by "post-hypnotic suggestions" the hypnotic process continues: the subject remains set to carry out the "post-hypnotic suggestions", to go "deeper into trance" if necessary, and to conceive himself and his surroundings as defined by the operator.¹²

D. CONCLUSION

Hypnosis is not a "state of consciousness." Hypnosis is not a "thing" or an "entity." Hypnosis is not something which "makes" a person behave in un-

completely redefined the interpersonal relationship, e.g., when he asked the subject to join him in the cafeteria for a cup of coffee.

¹⁰Erickson concluded from an earlier study (28) that subjects "invariably develop a hypnotic trance" when carrying out a "post-hypnotic suggestion." To test the validity of this finding the writer gave the signal for the "post-hypnotic" behavior when the subject was speaking (more specifically, when he was in the middle of a sentence). If the subject stopped speaking in the middle of a sentence when he became carried out the "post hypnotic" behavior the writer concluded that he had become relatively unconcerned about his surroundings, i.e., he had gone "deeper into trance." When the "post-hypnotic suggestion" was to "scratch your head when I comb my hair," *the subjects continued speaking without the slightest pause or interruption as the writer began combing his hair and as the subjects performed the scratching behavior.* However, when the "post-hypnotic suggestion" was complex, e.g., "You will see a (hallucinatory) cat enter the room when I pick up a cigarette," *the subjects typically stopped speaking in the middle of a sentence (when the writer picked up the cigarette), looked away for about 15 seconds, and then said, "Pardon me. What was I saying? I just noticed that you have a cat. I hadn't noticed it before."*

¹¹The only difference in the "post"-hypnotic behavior of these two groups of subjects is that those without "amnesia" usually state *why* they are going to carry out the "post-hypnotic suggestions," e.g., "I know this is a post-hypnotic suggestion but I guess I better carry it out. I'll feel uncomfortable if I don't do it."

The oft-repeated statement "The hypnotic subject is unconscious of why he carries out a post-hypnotic suggestion" is misleading. If the subject is *not* given "amnesia" for the hypnosis, he knows perfectly well why he is carrying out the "post"-hypnotic act. Only "amnesic" subjects, i.e., subjects who "believe" that they cannot remember, do not "know" why they carry out the (post-hypnotic) act.

¹²In forthcoming communications the writer will indicate how the principles developed in this paper can be applied to the phenomena of "hypnotic amnesia," "age-regression," "negative and positive hypnotic hallucinations," and "hypnotic induction of multiple personality."

usual ways. Hypnosis is a descriptive abstraction referring to an interpersonal relationship which is characterized by a number of overlapping processes. Taking the subject as our frame of reference these processes can be conceptualized as follows: (a) the process of becoming concerned only with the words of the hypnotist and those aspects of his self and his surroundings to which the hypnotist specifically directs his attention, (b) the process of becoming ready and willing, i.e., "set," to carry out the instructions of the hypnotist, and (c) the process of coming to believe that the hypnotist's words are true statements.

When the subject is concerned only with the words of the hypnotist and when he literally believes that the hypnotist's words are true statements, he experiences many or all of the hypnotic phenomena. When he "believes" that another person's purse is his own, he *responds* "anti-socially," i.e., he does not hesitate to "steal" the other person's purse; when he "believes" that he is insensitive to pain, he does not give the expected "pain" response to noxious stimuli; when he "believes" that he is color-blind, he *responds* to the Ishihara test as if he does not "perceive" color.

The psychology of hypnosis is therefore one aspect of the psychology of "belief" and "perception." The subject behaves in "unusual" ways only when the interacting and overlapping processes between the subject and the hypnotist are effective in altering the subject's "perceptions" and interpretations of himself and his surroundings.

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THE CONSTRUCTION OF A TEST BATTERY FOR COUNSELING MATURE INDIVIDUALS WITH PSYCHOLOGICAL RETIREMENT PROBLEMS*

Auspices of Western Reserve University

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A. INTRODUCTION

No preamble is required to establish the need for helping mature individuals plan for better adjustment by pre-retirement counseling. The usual psychological tests are inappropriate for work with such people. Existing interest and activity tests are vocationally rather than avocationally oriented. Both these and tests of personality, character structure, and value systems have for the most part been designed for and based on populations of teenagers and college students. To meet the needs of adequate pre-retirement counseling avocationally oriented interest tests and new personality measuring devices constructed with reference to the existential framework of mature people are required. This report covers the construction of a new three-test battery designed for use with mature individuals.

Several years ago the senior author had made a study of avocations and retirement plans of senior executives in a large corporation. The results are unfortunately unavailable for publication. Out of the needs for new devices uncovered in this study, however, he began research on forced-choice measures¹ of the activities and interests which are employed as a portion of the present battery. When prior study (conducted under a private grant) indicated considerable promise in this approach, the project was expanded to incorporate forced-choice measures in both personality and value judgment areas and then continued under the sponsorship of a United States Public Health Grant.²

Preference values of interest and activity variables were obtained on over 500 potential items with a sample of 100 men and women aged 45 to 65. The approach was "avocational interest" and from this comes the forced-

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¹The special advantage of forced-choice over ordinary question methods is the tendency to reduce the inclination of subjects to cheat or to make only socially acceptable responses.

²USPHS Research Grant M-1034, conducted under the auspices of Western Reserve University.

choice pairs which were established for 100 pre-retirants in the earlier (unpublished) work of the senior author.

In the personality area the junior author had been for several years administering conventional personality tests to applicants for and incumbents in sales, engineering, and managerial positions in a wide variety of industries. These tests had been administered in a "for keeps" situation since the subjects were either being considered for management level positions or promotion. The personality test items (primarily Guilford-Zimmerman) were analyzed to determine the frequency of response to each item. One hundred randomly selected cases were used for this purpose. These "item difficulty" values constituted the preference values used for construction of the forced-choice personality test pairs. The *a priori* keying of the items was based on the tests in which they had been used in a conventional personality questionnaire.

Several false starts were made in an attempt to tap the life-value and character structure of mature individuals. A "Proverbs Test" suggested by Baumgarten (1) appeared to us to be a fresh and promising approach especially for mature individuals. We began by searching the *Bible* and Bartlett's *Familiar Quotations* for phrases with basic philosophical connotations. Additional proverbial phrases were created by the authors to insure a more complete coverage and their appropriateness to current mores. A total of 390 potential items were used. To secure the preference values, these were set up in two forms of 200 items each (there were 10 duplicate items to enable the determination of the comparability of the populations). These forms were distributed to mature individuals in executive and managerial positions in a number of industrial organizations. These men were asked to rate the items in accordance with the following instructions:

This is part of a research program to develop instruments to help people plan for retirement. This is a preliminary form to help identify mature people's relative emphasis of a variety of adjustment areas and value judgments.

This form contains 200 proverbs and other kinds of philosophical statements. As you read over these items think of each of them as applying to a person you know. Then rate each item on the scale according to what you would think of the attitude of a person who agreed with the item. Mark a check mark in one of five columns depending on how definitely you would approve or disapprove of attitudes of a person believing what the item says.

The five points on which you are to rate people's attitudes are:

1. I would definitely disapprove of his attitude.
2. I would probably disapprove of his attitude.

3. I would neither approve nor disapprove of his attitude.
4. I would probably approve of his attitude.
5. I would definitely approve of his attitude.

EXAMPLE: Suppose that one of the statements reads, "True friends are the greatest riches" and that you *definitely approve* of the attitude of a person who believes this statement. Then you would put a check mark in the *fifth* column opposite this statement thus:

True friends are the greatest riches . . .

				✓
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.

Please express an opinion on every question. *Do not write your name anywhere on the form.*

One hundred and seventy-five subjects supplied ratings on these forms. The mean rating provided the preference value for each item.

Thus the ingredients of a three-test battery were secured. The composition of the battery was as follows:

- A. A measure of activity-interests covering eight areas and composed of 112 forced-choice pairs. These areas were:
 1. Artistic (art, music, etc.).
 2. Collecting and Historicals.
 3. Mental Gymnastics (cards, chess, mathematical problems, etc.).
 4. Nature (plants, pets, etc.).
 5. Mechanics (inventing, science, do-it-yourself, etc.).
 6. Social (welfare, charity, socializing, etc.).
 7. Physical Sports (golf, fishing, baseball, etc.).
 8. Escape (reading, travel, TV, etc.).
- B. A measure of five personality variables consisting of 60 forced-choice pairs. The factors covered by this test were:
 1. Ascendency (tendency to exercise control over others—ego inflation).
 2. Sociability (tendency to seek association with others).
 3. Objectivity (tendency to see self as seen by others—reality oriented).
 4. Emotional Stability (tendency toward bona fide detachment and/or overt control).
 5. Energy (physical indefatigability and/or activity-output control).
- C. A measure of five bi-polar character structure areas consisting of 72 forced-choice pairs. These were:
 1. Hedonistic—purposive.
 "All work and no play makes Jack a dull boy" (Amusement). vs.
 "Life is real: life is earnest" (Purposive).
 2. Adventuresome—cautious.
 "Life without danger is dull" (Risk). vs.
 "Only fools take chances" (Caution).

3. Conformity—independence.
“Civilized men live by rules” (Conformity). vs.
“Popular opinion is the greatest lie in the world” (Non-Conformity).
4. Selfish—altruistic.
“All men are enemies” (Self). vs.
“All men are brothers” (Social).
5. Moral—materialistic.
“The wicked flee when no one chases” (Ethical). vs.
“The end justifies any means” (Ethical).

An almost inexhaustible array of human characteristics undoubtedly exist in relation to the general areas covered by the three tests. The particular variables mentioned above obviously indicate that selections had been made. These selections represent a combination of the author's professional judgment, experience in counseling mature people, and existing research results.

In the case of the interest-activities test, the earlier unpublished research of the senior author encompassed a much more extensive list of interest-activity areas. Starting with 20 areas drawn from analysis of this avocational interest work, it was found that a number of these were closely enough related (e.g., music-art) to permit their combination. In the case of others it had been found that their frequency of interest occurrence (e.g., *linguistics*) was so small as to render their inclusion in the test impractical. The eight areas finally selected thus represent combinations of correlated sub-fields found to occur infrequently among mature hobbyists.

In constructing the personality portion of the test, we were, of course, confined to those variables for which the data essential to determining the preference value were available; but here, too, practical consideration necessitated some eliminations. Since our prime objective was to develop an instrument of aid to pre-retirement counseling, the authors selected (on the basis of their best professional judgment and counseling experience) the five variables they felt would be most valuable.

In the case of the life-value test, the variables were empirically determined. When nearly 500 items had been developed, they were independently classified by eight trained psychologists. Items for which homogeneity of classification did not exist were discarded. Six major (bi-polar) areas resulted, but one of these—the economic—had to be discarded because of invariability of the preference value (practically none of the subjects who rated the items would admit admiration or acceptance for the wealth-power value system). Consequently items in this category could not be matched on basis of preference for items in the other areas. While we also found no acceptable oppo-

site for the moral-materialistic philosophy, the range of preference of items in this category was adequate enough to enable its inclusion in the test.

B. THE EXPERIMENTAL DESIGN

In order to secure an independent external criterion against which to validate the individual paired items in each of the tests, arrangements were made for one or the other of the authors personally to interview each member of the sample. Individuals invited to participate as subjects were all of executive, professional, and managerial level personnel. They were asked to check forced-choice test forms before being granted a private counseling type interview. The test and the interview were sometimes administered within several days but more often were separated by many weeks. To favor spread of geographic location and work activity, the interviewed subjects were both in the East and Middle West. Some of the subjects (about one-third of the men and all of the women) were personally known to the senior author for rather long periods and so interviewed as friends. The other members of the male sample were complete strangers to the interviewers.

1. *The Interview Method*

The structured interviews (conducted by the authors with forced-distribution check list) employed as informal an atmosphere as possible. Discussions took place in the subject's private office, in his home, or in the offices of the junior and senior authors. Introductory openings usually ran like this:—

Most of us are so busy with today's problems that we have scant time or opportunity to think about those of tomorrow. We are called "successful" so often we seldom stop to wonder if we will do equally well when we leave our present world of work or are "expected to retire." Here is a chance for us to exchange views on and think about various areas in this yet-to-come change in our lives. For instance, ever had occasion seriously to discuss your pattern of living with someone who has your confidence—life purposes—your philosophy of life—your various interests or aptitudes and how personality factors seem to affect vocation and avocation? This can be such an occasion:—Let's begin by thinking about what makes life worthwhile for you.

The interview form³ was then brought out and checked by the author as his questioning moved through the areas indicated.

Attitude Toward Vocation

To what extent has your work-life been a source of satisfaction beyond its monetary return—beyond its prestige and privileges? You

³At present interview and test forms are available for study only in the offices of the authors.

may have noted that in our retirement planning test we scrupulously avoided asking questions about four areas (sex, politics, religion and economics). This was done for two reasons (1) these areas are considered particularly private in our culture and we felt you might not care to express your feelings on them (2) mature individuals appear equally "adjusted" regardless of the special nature of their thinking on these four areas. For instance, Democrats and Republicans seem equally well adjusted; Protestants and Catholics can get on equally well; the graspers and the givers both have their good and bad points; the promiscuous and puritanical both enjoy life in their own way; even communists and homosexuals—what is all this leading up to??? If you think a certain point of view in any of these four areas is important in retirement planning, we would appreciate your thinking on the matter.

Family Problems in Retirement Planning and Avocations

No man is an island. We all have obligations to others which interfere with doing—or planning to do—just as we please. In most instances, these obligations are up to our immediate family, our wives, children and relatives. To what extent and in what ways do you think family problems may interfere with or alter your plans for the future? To what extent have you participated in the avocational activities of other members of your family?

Successful Work Activity and Retirement

By the usual standard you would be considered a successful man, living a successful life. Do you so consider it? You have money, position, status and presumably are working at the thing you like best. To what extent is this true? If you do have regrets, what and why?

The Secret Life

There is some "Walter Mitty" in every one of us. At times we have all dreamed of doing something different from our regular work. Some of us steal hobby hours unknown, guard the secret. Others see "retirement" as an opportunity to be the man they always wanted to be. How is it with you?

Activity Consistencies

How long have you followed your major avocation? Do you have one? What other hobby activities have you tried and left behind—which do you still find appealing even though you've never done much about it—might this be the kind of thing you would do when you retire—contrast the man with closet full of ex-hobby supplies vs. the devotee, always discovering new facets of interest and activity in essentially the same field.

2. *Open End Questions*

These attempts at open-end discussion cannot be properly assayed at present. Nonetheless the authors include a typical sampling.

How should leisure time be spent—what's it for (as escape from work irritation or as opportunity for improving yourself and the lot of mankind)? How hard do you think one should work at play? If not at all (just satisfied in being a happy duffer)? If one should try hard (then where is the fun)? To what extent do you think native ability determines type of avocational pursuit and level of proficiency? If good at something, why is it not done vocationally? What's the advantage of doing it avocationally? To what extent is hobby choice a function of chance and achievement a function of outside pressures—such as—? What, if any, is the difference between a hobby and an avocation? Could your avocation be a possible substitute vocation? Do you believe in mandatory or voluntary retirement and why? What should determine when a man retires? What should be the ideal rôle of the retired executive in our society? Do you favor sending him out to pasture or offering opportunity for further usefulness? For what kind of people is shift to retirement activity the easiest, the hardest? Do you think it is easier for a day laborer than for an executive and why? What do you see as the value of hobbies in a busy working life? What do you see as the value of hobbies in retirement?

Whether one has the health, money, or inclination to change his mode of life, his activity and interests—if he shifts in retirement exclusively to play or only to another kind of work all this, of course, is an almost impossible thing to assess when subjects such as the authors interviewed were in the prime of life and seldom had time to think of retirement. Nonetheless, what they did see in the interviews suggested that some would be able to make a superb adjustment in completely unrelated activities (a rocking chair in front of TV), while others will do just as well by perseverating and doing what amounts to essentially the same thing they did when actively in business (fund raising drives, organizational activity, etc.). By the same token, of course, other people in each category would probably be miserable when they retired.

Which mode of retirement attack and degree of adjustment one will achieve remains a basic question. But thinking about it in advance (for our interviewed subjects at least) indicates that the majority (60 per cent) anticipate a life of continued usefulness after age 65 rather than active self-indulgence or vegetation only. This may well be a function of the high caliber of men included in the sample.

While these responses may constitute interesting speculations with reference to the broader problem of pre-retirement counseling, they were

not the prime purpose for which the interviews were conducted, i.e., to provide an independent criterion against which to select the most valid items in the experimental battery. To achieve this two kinds of data were collected. During the course of the interview the authors rated the interviewee on a three-point scale with reference to the 22 variables that the battery was being constructed to measure. In addition, biographical data were collected during the testing, and 10 additional interview ratings were made to enable better characterization of the population. These are discussed in the next section.

C. THE SAMPLE POPULATION: CHARACTERISTICS OF THE SAMPLE

The subjects (105 men and 20 women⁴) who formed our sample were executives from 45 to 65 years of age, all still actively engaged in their work or vocation, the vast majority making between \$7,500 and \$20,000 (with six at \$6,500 and four well over \$25,000). Over 65 per cent took the test with expressed thought or need that it would help them with their planning for retirement; the other 35 per cent are judged by the authors to report (being aware of) no obvious retirement problems, at least so far as finances, activities, and interests go. Of the entire group only 31 per cent reported having given the matter of retirement serious thought.

Of the total group 65 per cent worked for companies where retirement is mandatory at 65, the rest (35 per cent) owned their own businesses and could continue working as long as they wished. Practically none of this latter group carried company pension or retirement insurance; for the entire population sample the coverage of either company pension or a retirement annuity is 67 per cent. In other words, practically no financial provisions for retirement had been made by those lone wolves not covered by company retirement plans.

While it was the original intent to confine the sample to executives in sizable industrial organizations, experience necessitated some use of available subjects engaged in a variety of professions, e.g., law, medicine, art. It might be noted that this special segment of the population had (a) given practically no thought to retirement planning, and (b) had made no provision (financial or otherwise) for this eventuality.

Table 1 presents the distribution of the interviewers' ratings of biographical factors which were thought to impinge upon the likelihood of successful retirement.

⁴The sample of 20 women (which was purely exploration) is not included in data here presented.

TABLE 1
INTERVIEWERS' OBSERVATIONS ON FACTORS INFLUENCING RETIREMENT

	High	Medium	Low
Vocational satisfaction	75	25	5
Feeling about "success"	In the groove 48 Essential to plan	Some regret 55 Moderate importance	Slave to success 2 No importance later life
Possible factors			
Sex	17	55	33
Politics	8	79	18
Economics	40	54	11
Religion	31	51	23
	Will own me	Moderate assistance	Will follow my lead
Family attitudes	34 Completely	61 Occasionally	8 Not at all
Family participates in your avocations	27 Many	62 Some secret life	16 Few
Interests outside work	50 High	35 Fair	20 Many discarded
Avocational consistency	66	35	4

TABLE 2
YEARS ON THE JOB

Number of years	Number of subjects on same type of job	Number of subjects with same company over this period
1 or less	5	none
5	46	15
10	21	15
15	18	21
20	12	8
30	none	11
Well over 35	3	21

TABLE 3
VOCATIONAL AREAS

Main vocational field	Number in sample
Engineers and research directors	14
Social service professions: doctors, lawyers, teachers, preachers	12
Industrial publicity and public relations (including staff personnel)	15
Supervisors and administrators; Industrial line personnel	34
Sales (buying and selling, including investments and accounting)	15
Writers, artists and creators (professional)	15

Table 2 presents a distribution of time on the same type of job and with the same company. This wide variability suggests high motility (direction up) for some and considerable job stability for others.

To measure occupational stability each interviewee was asked to enter what he considered his main vocation, e.g., accountant, engineer, sales. These data indicate the vocational spread of the sample and are presented in Table 3.

The subjects included in each age group in the sample are as follows: around age 45, 9; 45 to 50, 30; 50 to 55, 20; 55 to 60, 28; 60 to 65, 18.

Tables 4, 5, and 6 present in a similar manner (to Table 3) other distributions of other biographical data with reference to the sample.

TABLE 4
EDUCATION

Educational level	Number in sample
Some high school	6
High school graduates	8
Some college	28
College graduates	38
Advanced or professional degree	25

TABLE 5
INCOME

Income brackets	Number in sample
5,000 to 7,500	2
7,500 to 9,999	11
10,000 to 14,999	49
15,000 to 19,999	28
20,000 to 24,999	8
Over 25,000	7

TABLE 6
MARITAL STATUS*

Marital status	Number in sample
Married 35 years or more	18
Married over 25 years	33
Married over 20 years	17
Married over 15 years	12
Married over 10 years	13
Married over 5 years	4
Single	3
Remarried—no data	7

*Marital status shows considerable variability in the sample but high stability overall, far in excess of population norms.

The children of the above sample number 121, of whom 83 (more than 2/3) are counted as still dependent. Of the 105 men in the sample, 80 sired at least one child and 25 reported having no children.

D. THE INTERVIEW RATINGS AS CRITERIA

Sound research design calls for the use of an independent external criterion against which to determine the validity of the individual items in the battery. The interview ratings described above were collected primarily to provide such criteria for the 22 scales in the battery.⁵ The alternate (and less desirable) procedure is the more customary one of performing item analysis against the several total scores on the tests.

Because of the antecedent research on which the *a priori* keys had been based, it was decided first to determine the relationship between these keys and the interview ratings. A second factor in determining this decision was the feeling on the part of the authors that in interviewing (for the brief period available and with the particular apperceptive mass that the interviewee possessed, i.e., that the prime purpose of the interview was to offer the interviewee pre-retirement counseling) they were unable in many cases to make the evaluations with any great degree of certainty.

The most obvious results of this analysis as shown in Table 7 is the generally low order of magnitude of the relationship between interview rating and tests scores, particularly in the personality factors and life values areas. Interests, on the other hand, generally show substantial relationship between tests and ratings. The question of validity is not answered by such results; but it is clear that insofar as personality and life-values are concerned, the interview ratings and the test scores were not evaluating the same thing.

E. A VERIFICATION STUDY

In an effort to ascertain, if possible, the reasons for the low relationships which obtained with the *a priori* correlation, the senior author selected a group of 20 subjects (from the total 105 population) with whom he had been interminably acquainted (in some cases as long as 20 years). In spite of the small size of this sample, it was felt that knowledge of relationship between tests and interviews within this group would be indicative of the value inherent in further analysis of this retirement test battery data. Because of his more intimate knowledge of the people interviewed, this rater was able to make his evaluation in a 5- rather than a 3-point scale. This increment of the variants of the "criterion" variable would of itself help expose any relationship obscured by the cruder scale. In addition, the senior

⁵In constructing the proverb test consisting of five bi-polar variables, separate scores were computed for each pole on each of the variables except the "moral-materialistic." Consequently nine rather than five ratings were made for this test. This resulted in a total of 22 variables in contrast with the 18 reported above.

TABLE 7
CORRELATIONS, MEANS AND STANDARD DEVIATIONS BETWEEN FORCED-CHOICE SCORES IN
THREE TEST AREAS AND PSYCHOLOGISTS' RATINGS FOR TOTAL MALE GROUP

RATINGS FOR TOTAL MALE GROUP						
	<i>N</i>	Scores		Ratings		
		Mean	<i>SD</i>	Mean	<i>SD</i>	<i>r</i>
<i>Personality factors</i>						
Ascendency	101	10.17	2.25	2.07	.64	.01
Sociability	101	11.58	2.53	2.37	.68	.17
Emotional Stability	101	14.08	2.33	2.35	.58	.10
Objectivity	101	10.65	2.85	2.36	.66	.09
General Activity	101	13.70	3.13	2.42	.61	.25
<i>Interests</i>						
Artistic	84	11.87	5.38	1.88	.83	.58
Collecting, History	84	12.98	5.30	1.77	.79	.58
Mental Skills	84	12.58	4.38	1.89	.70	.17
Nature	84	15.55	5.05	2.01	.76	.42
Mechanics, Inventing	84	14.35	4.52	1.96	.77	.42
Social Service	84	13.60	4.33	2.08	.77	.38
Physical Sports	84	15.55	3.63	1.92	.74	.38
Escape	84	15.54	3.23	1.94	.63	.14
<i>Life values</i>						
Amusement	90	8.39	3.08	2.19	.68	.26
Purposive	90	9.09	2.31	2.54	.59	.21
Risk	90	8.48	2.10	1.92	.64	.04
Caution	90	8.01	2.19	2.28	.61	-.13
Conformity	90	7.69	2.32	1.93	.71	.14
Non-conformity	90	7.88	2.09	2.11	.67	.08
Self	90	7.60	2.18	1.92	.64	.14
Social	90	8.84	2.34	2.08	.64	.02
Ethical	90	7.02	2.56	2.14	.62	.01

author was able to interview and test 20 females (career women and executives' wives) with whom he had long been acquainted. The correlations for these two subpopulations are presented in Table 8.

Two encouraging observations are suggested by this table; first, when the interviewer's contact with an individual is more extensive than that permitted in a short discussion with a total stranger, the relationship between rater judgments and test scores rises substantially; second, these correlations are by and large higher for the male subpopulation than they are for the females. From these findings we draw the following tentative conclusions: (a) that the tests as originally constituted are substantive measures of what the authors were attempting to evaluate in their interview, and (b) within the confines of available data, these tests could best be improved through the medium of internal consistence analysis rather than by correlating the individual items with the criterion ratings for the total male sample. These tentative conclusions, we feel, are buttressed by a comparison between re-

TABLE 8
CORRELATIONS BETWEEN FORCED-CHOICE SCORES IN THREE TEST AREAS AND SENIOR
AUTHOR'S RATINGS ON SELECTED GROUPS OF 20 MALE AND 20 FEMALE SUBJECTS

	Men	Women
<i>Personality factors</i>		
Ascendency	.65	— .07
Sociability	.67	.54
Emotional Stability	.48	.04
Objectivity	.84	.03
General Activity	.76	.64
<i>Interests</i>		
Artistic	.74	.56
Collecting, History	.72	.16
Mental Skills	.67	.17
Nature	.91	.73
Mechanics, Inventing	.79	.50
Social Service	.78	.60
Physical Sports	.57	.08
Escape	.72	.48
<i>Life values</i>		
Amusement	.66	.28
Purposive	.69	.47
Risk	.70	.60
Caution	.77	.10
Conformity	.63	.10
Non-Conformity	.62	— .38
Self	.57	.05
Social	.42	.38
Ethics	.77	.13

spective pairs of correlation in the male and female subpopulations. Such reasoning stems from the fact that preference values for items in all three tests were based on a completely male population. Cultural differences that our society imposes upon men and women would very obviously render male preference indices in the personality and life values areas less appropriate for women. Consequently, it was decided to perform the item analysis by computing point bi-serial correlations for each item against the total score of interest, personality or value area to which it had been assigned as well as against the interviewers rating for that variable.

F. RATIONALE ITEM ANALYSIS RESULTS

No basis exists for assuming that individual items in the three-test battery represent a nominally distributed variable dichotomized at its p value. Therefore, any statistical technique (such as the bi-serial, upper-lower 27 per cent, etc.) dependent on assumptions of normality appeared inappropriate. Instead the point bi-serial correlation coefficient was selected for the item analysis

because of its high level of interpretability and freedom from questionable assumptions with regard to the nature of the distribution subtending the dichotomized variable (individual items).

As is customary in item analysis in populations of this size (n equals 105) a minimum point bi-serial correlation of .20 was arbitrarily chosen as the criterion for item selection in all three parts of the test battery (i.e., if the point bi-serial correlation between an item and the score of which it formed part of a forced choice pair attained a magnitude in excess of .19, that item was selected for inclusion in the next experimental key). Contrariwise, items less closely related to their respective *a priori* score were not included in the new key. In any further work with the battery, such unscored items are being retained in the tests. This is necessary because an invalid item on one key is frequently preference-paired with a valid item from another key. For example, in the personality test, an *ascendency* item whose point bi-serial is .07 may be preference paired with an *emotional stability* item whose point bi-serial is .47; the elimination of the invalid member of this pair (*ascendency* .07) would require the simultaneous deletion of (*emotional stability* .47) its valid partner. Rather than discard the valuable *emotional stability* item or re-pair it with some other valid item (requiring a new item analysis), the entire pair is thus retained but the .07 *ascendency* item, instead of being keyed becomes a "dud." This in no way impairs the validity of the .47 *emotional stability* item.

Tables 9, 11, and 13 present the distributions of the point bi-serial correlations between the selected items and the *a priori* keys of the personality, interest and value sections respectively. Each of these tables also presents the number of selected items and the median correlation of selected items.

TABLE 9
DISTRIBUTION OF r_{pbi} FOR ITEMS VS. SCALE SCORE: SELECTED ITEMS, PART 1: PERSONALITY

r_{pbi}	Ascendency	Sociability	Emotional stability	Objectivity	General activity
60-64					
55-59					
50-54					
45-49				1	1
40-44	1	1	1		
35-39	2	3	1	1	2
30-34		3	5	4	1
25-29	3	2	3	2	3
20-24	1	3	3	2	4
N	6	2	3	3	5
Median r	13	14	2	2	1
	27	35	15	15	17
			34	36	32

Tables 10, 12, and 14 show the "item difficulty" (p) value of the selected items and the median for each variable. Because each subject was required to respond by selecting one of two alternatives in each item pair, the median p for each section of the test is necessarily .50. If the preference values on the basis of which individual items were paired were stable and unaffected by the pairing, the item difficulty distribution of each scale should differ only

TABLE 10
DISTRIBUTION OF p VALUE FOR ITEMS VS. SCALE SCORE: SELECTED ITEMS,
PART 1: PERSONALITY

p value	Ascendency	Sociability	Emotional stability	Objectivity	General activity
80-84			1		
75-79					
70-74			2		4
65-69			1		3
60-64	2		2	1	2
55-59	2		4	1	3
50-54	2	3	2	4	1
45-49	1	2	2	3	2
40-44	2	4		1	
35-39	1	1	1	2	1
30-34	1	4		3	
25-29	2				1
20-24					
N	13	14	15	15	17
Median p	.48	.41	.57	.45	.61

TABLE 11
DISTRIBUTION OF r_{pbi} FOR ITEMS VS. SCALE SCORE: SELECTED ITEMS, PART 1: INTERESTS

r_{pbi}	Artistic	Collection & history	Mental skill	Nature-pets	Mechanics	Social service	Sports-athletics	Escape
70-74		1						
65-69	3					1	1	
60-64	2	5		3		2	2	
55-59	3	3	1	2	5	4	1	
50-54	5	5	8	5	3	2	6	
45-49	4	1		1		1	2	2
40-44	2	4	4	2	6	1	3	3
35-39	2	4		5	4	2	3	7
30-34	3		4	1	1	5	1	3
25-29	1		2	2	2	2	1	1
20-24			2	2	1	1	2	2
N	25	23	21	23	22	21	22	18
Median r	.50	.51	.42	.43	.43	.43	.50	.35

TABLE 14
DISTRIBUTION OF p VALUE FOR ITEMS VS. SCALE SCORE: SELECTED ITEMS, PART 1. VALUES

p value	Amusement	Seriousness	Risk	Caution	Conformity	Non-conformity	Selfish	Social	Ethics
80-84			1						
75-79	1		3	1					1
70-74		2	1		1			2	1
65-69	1	1				2	1	1	1
60-64	3	1		3	5	4	1	5	
55-59	2	4	1				1	2	1
50-54	1	2		2	1		3	1	1
45-49	2		1		1	2	2		1
40-44	2	2		1	1	5		1	2
35-39	2		3	4	3			1	3
30-34	1		1	1			1	2	2
25-29			1	1	2				2
20-24		1	1	2		1	1		
N	15	13	13	15	14	14	12	15	14
Median p	.54	.56	.46	.39	.50	.48	.50	.60	.42

on the basis of chance from the median of .5. Considering the fact that perfect preference matching could not be achieved, this distribution can be said to come satisfactorily close to possessing the desired characteristics. Medians generally range between .4 and .6. None of the distributions is markedly skewed and few p values fall in the extreme ranges ($.20 < p < .80$). Such items might perhaps best be omitted from the next experimental key.

In the *personality* section, 74 or 62 per cent of the 120 items in the five *a priori* keys were selected on the basis of the internal consistency analysis. The number of items selected per key ranged from a low of 13 to a high of 17.

In the *interest activities*, 175 or 78 per cent of the 224 possible items met the criterion of selection. Again none of the scales shows any really marked superiority as indicated by the number of items selected, nor the median value of the item total score point bi-serials. It might be noted in this connection that the median r 's which range from .35 to .51 for the *interest* tests are considerably higher than those for the *personality* variables. The latter range from a low of .27 to a high of .36. Making the same comparisons with reference to the *life values* section (Table 13) we find that 125 or 87 per cent of the 144 possible items met the internal consistency criterion.

As in the sections of the test, there is high consistency in the number of items selected per scale, the range being from a low of .12 to a high of .15. The median test item correlation is again thoroughly constant ranging from a low of .28 to a high of .45.

It is interesting to note that the *personality* section items (of which there were 24 per scale) showed the lowest proportion of selected items as well as the lowest median item test correlation. These results obtained in spite of the fact that all of the items used had long histories in previous personality tests and that the preference values were obtained on a basis of actual frequency of use by well motivated subjects. The *a priori* keys on this test were based upon the context in which they appeared in their original source. The *interest* tests by contrast which had the highest median test item correlation also had a larger number of items per scale (28) and the pairs as noted earlier had previously been employed in forced-choice form. On the other hand, the *cliche* test was only 16 items per scale and yielded the highest proportion of selected items and median item test correlations, somewhat lower than the *interest* tests and in about the same range as the *personality* section. No conclusions can of course be drawn from these observations but they suggest some interesting hypotheses that might bear further exploration.

Recognized Limitations: It will be recalled that the pre-retirement test battery sought to explore three arbitrarily defined areas viz: *Personality*, *Interest Activities*, and *Value systems*. Each of these consisted of five or more variables. By methods previously described, every item in each area was specially associated with one and only one of its variables. In this internal consistency analysis, no effort was made to determine the relationship of any of the items to any variable other than that to which it had already been assigned.

G. NEXT STEPS

Test construction and test validation are two important and yet quite distinct processes by means of which psychological devices are constructed and made into useful tools for counseling purposes. Logically it would be desirable to perform both of these steps (as we attempted to do) simultaneously through the validation of each of the several items against an external criterion. Unfortunately by virtue of the inadequacy of our interview criteria this effort aborted and we consequently reverted to an internal consistency analysis which yielded a number of consistent scales. We are hopeful that these three scales are measures of the variables they were constructed to measure. However the main evidence on this score comes from the side

study of the senior author—three ratings of the 20 men and 20 women well known to him. Thus in the present study we have ready instruments to a point where standardization and validation on new populations and with new approaches are needed to accomplish the ultimate goals of this research. The battery in its present form needs to be administered to a large and representative sample of the universe in which it is to be operationally employed. In addition the real relationship of scores on various test variables to retirement adjustment on both a concurrent and predictive level must be established through the collection of more adequate criterion data. This is going to require more intensive interviewing and the use of other criterion gathering techniques of a much less restricted population than that employed in order to encompass the wide range of activity possibilities with which the run-of-the-mill retirants are confronted.

In other studies that the senior author has initiated with criterion groups of already well defined specific avocational interests there appear indications that while the interests test does its job in its present form, it fails to touch with any high degree of certainty upon the satisfaction level and over-all critical adjustment of the individual who is trying realistically to anticipate and face up to his approaching retirement. The other two sections of the battery as a revised experimental form have been incorporated in this research in an effort to determine if they can be used as a means of predicting such satisfaction and clinical adjustment. The possibility exists of course that the personality and value section of the battery may have broader use as psychological measuring devices than that encompassed by pre-retirement counseling. The junior author is currently in the process of attempting to make such determinations, while the senior author endeavors to improve their predictive power in later maturity study.

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Americana Life Foundation
Century House
Watkins Glen, New York



LYSERGIC ACID DIETHYLAMIDE (LSD-25): XXV. EFFECT
ON SOCIAL ORDER OF NEWTS, *TRITURUS V.*
VIRIDESCENS (RAF.)*¹

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A. INTRODUCTION

Aggressiveness in amphibian species is difficult to observe and has been reported in relatively few instances. Lantz (10, 11) describes chasing and butting between males of *Ambystoma opacum* in the breeding grounds prior to the arrival of females. Cagle (4) and Hill (9) report tooth marks and mutilations on the bodies of *Amphiuma* which indicate that intraspecific fighting is common in this form, especially in the mating season. Grant's (8) description of fighting in two species of salamanders, *Hemidactylum acutatum* and *Eurycea bislineata*, is significant. When several of the same species were placed in a vivarium which was prepared with moss and forest debris to simulate the natural habitat, two specimens quickly occupied territories at either end of the vivarium. The others failed to establish home areas. When one of the latter entered a territory at the end of the vivarium, the resident approached the intruder until their snouts touched. After an interval the intruder backed away. On a few occasions, however, the latter was bitten on head or tail before it retreated. Spurway (12) has shown that the adults and aquatic efts of the European newt, *Triturus c. cristatus* (Laurenti), a close relative of the species used in this report, exhibits pugnacity and a definite hierarchical peck-order.

Among the anurans, Test (13) observed that the Venezuelan frog, *Phylllobates trinitatis bulengeri*, exhibits marked territorial combativeness. Individuals set up separate territories along the streams. Adult females and newly metamorphosed individuals appear to be the most aggressive when their home areas are invaded. The resident greets the intruder with a bril-

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liant yellow, pulsating throat sac-display (visual-releaser). This usually causes the stranger to withdraw but if it still remains, the resident then hops upon its back. The intruder quickly retreats. The South African male bull frog, *Pyxicephalus adspersus*, drives the female away after the pair has spawned, while he remains to guard the eggs and later the tadpoles. Other males of the same species as well as other creatures are viciously attacked if they approach too close. It is usual for the aggressive parent to squat in shallow water, completely surrounded by his swarming progeny. As he moves slowly about the pond the tadpoles follow and swiftly flock about him again (3). Aronson (2) observed that a single or unattached male *Bufo americanus* takes definite aggressive action to dislodge a rival male which is in mating embrace with a female.

B. PROCEDURE

The following study of aggressiveness on the part of the common eastern newt, *Triturus v. viridescens* (Raf.) was begun at The Biological Laboratory, Cold Spring Harbor, Long Island, New York, and continued at the Albert Einstein College of Medicine, Department of Anatomy. The data as given in Tables 1 to 8 are based on observations made upon a total of 57 newts which were divided into groups as follows: Hierarchy 1—four adult females, one young adult female, three adult males. Hierarchy 2—made up after the study of Hierarchy 1 had been completed, the same four adult females and Male B from Hierarchy 1. Hierarchy 3—three young adult females, one young adult male. Hierarchy 4—three young adult males together with adult Male A from Hierarchy 1. Hierarchy 5—four so-called juveniles but in the final aquatic phase; sex indistinguishable. Hierarchy 6—four so-called juveniles but in the final aquatic phase. In Table 7 is given data pertaining to the activity of 10 groups, each of which contained two newts. Table 8 gives data relating to the activity of seven groups made up of two in each. Positive identification of individuals was made possible by noting the specific patterns of red spots which differed in each specimen. More rapid identification of newts was established by cutting notches in the dorsal or ventral expansion of the caudal fin, which were renewed at intervals.

Aggressiveness was, with rare exceptions, confined to the feeding period. The most positive form of aggression was biting. Head bites were more often inflicted by the most dominant newt upon those immediately below it in social rank; leg or flank bites were more often suffered by those at the bottom of the hierarchy (bites are indicated in the tables

by # or *D*). Lesser degrees of aggressiveness are described as follows: A morsel dropped in front of one individual might be snatched by another (indicated in the tables by * or *F*). Less often an individual was observed to take food from the mouth of another (indicated in the tables by # or *D*). Another type of dominance was often noted when two newts were seeking the same morsel. If one, usually the larger, moved slowly forward, the other stopped. This permitted the former to secure the food (indicated in the tables by ' or *D*). If, however, the smaller newt suddenly gulped it the larger one would frequently bite the other. If, during the feeding period a larger newt approached to within an inch of another, the latter usually backed away. A newt of approximately the same size did not move until the dominating newt came even closer. This often ended by the dominating animal biting the other on the snout. Consequently, the dominating newt (in our study it was also the largest in the group) attacked the larger individuals more often than the smaller and lower ranking newts.

C. EXPLANATION OF TABLES

The horizontal row at the top of Tables 1 to 6 inclusive, lists the individual newts in each hierarchy. The same list of newts is shown in the left hand column. If these tables are read from left to right the data pertain to positive social contacts or episodic "victories" on the part of the animal concerned in the left hand vertical column. For example, in Table 1, Female *A* is shown to have bitten Female *B* 18 times, Female *D* 10 times, and Male *C* three times. In Table 2, Female *C* (*LSD*) before treatment (in the period from April 26 to May 13) is shown to have totalled four positive contacts, whereas in the post-treatment period (May 13 to June 6) her record of such contacts rose to 42.

If the Tables 1 to 6 inclusive, are read vertically, they show the record of positive social contacts imposed by other members of the hierarchy against each member as listed in the left hand column. For example, in Table 1 it will be noted that in the vertical column under Female *D*, Female *A* bit Female *D* 10 times, Female *B* bit Female *D* three times, and Male *A* bit Female *D* once. In Table 2, in the vertical column under Female *C* (*LSD*), note that Female *A* bit (#) Female *C* four times before and five times after *LSD* was administered to Female *C*. Note also that Female *D* failed to dominate (') Female *C* (*LSD*) either before or after Female *C* was treated. This type of table can also be used to record coöperative social contacts as well as aggressive ones (7).

In Table 7 is shown the data on aggressiveness as observed in 10 pairs of newts. Each pair was composed of a larger and a smaller newt, sex undetermined. These specimens are called juveniles. They were in the final aquatic phase with adult pigmentation but were not sexually mature. It will be observed in Tank 9, for example, that the small newt snatched food from in front of the larger newt six times (*F*) and dominated (*D*) the larger one nine times. The latter, on the other hand, snatched food (*F*) and dominated (*D*) the smaller newt 13 and 45 times, respectively.

Data are given in Table 8 which compare the behavior of the smaller newt in each pair toward its larger companion, both before and after it was treated with *LSD* 25 or a hormone (testosterone propionate, *TP*; interstitial-cell stimulating hormone, *LH*; whole pituitary, *Pit*). Observe, for example, that in Tank 2, the small newt snatched food (*F*) 11 times but failed to dominate (*D*) the larger newt during the pre-treatment period. In the post-treatment interval, however, the small newt snatched food (*F*) from its larger tank-mate 16 times and dominated (*D*) it 14 times. In the pre-treatment period, the larger newt was observed to snatch food (*F*) 13 times and to dominate (*D*) 28 times as compared with 16 (*F*) and 23 (*D*) times, respectively, in the post-treatment period.

D. RESULTS

Table 1 gives the data pertaining to hostility in adult newts during the period from July 18 to November 27, 1954. In this preliminary phase of the study only episodes in which biting was observed were recorded. It is apparent that Female *A* was virtually unopposed, having bitten others 49 times and being bitten only twice, once by Female *B* and once by Male *A*. These latter individuals stood in second and third place, respectively, in

TABLE 1
HIERARCHY 1: HOSTILITY BETWEEN NEWTS AS MEASURED IN TERMS OF BITES INFLICTED

	♀ A	♀ B	♀ C	♀ D	♀ E	♂ A	♂ B	♂ C	Total
♀ A		18	4	10	4	7	3	3	49
♀ B	1		3	3	0	0	1	0	8
♀ C	0	0		1	2	0	0	0	3
♀ D	0	1	3		1	0	0	0	5
♀ E	0	0	0	0		0	0	0	0
♂ A	1	0	1	1	1		1	0	5
♂ B	0	0	0	0	1	0		0	1
♂ C	0	0	0	1	1	0	0		2

F—Food snatched from in front of the other newt.

D—Biting, dominating, or taking food from the mouth of the other newt.

the hierarchy. While Female *D*, like Male *A*, bit others five times, the latter was more indiscriminate in his attacks and therefore might be considered as occupying third place while Female *D* probably belongs in fourth place. Male *A* proved to be definitely aggressive when he was placed with three other males (Table 4).

Tables 2, 3, 4, 5, and 6 include data on the effects of lysergic acid diethylamide (*LSD* 25) upon the social behavior of newts, gathered between April 26 and June 6, 1955, from five hierarchies of newts. In each of these groups one newt was immersed in a solution of 0.1 mg of *LSD* 25/ 20 ml water for two to three hours, depending upon the size. The treated newt was returned to its respective tank immediately after drug administration.

The period from April 26 to May 13 is indicated in the tables in alternate vertical columns with the symbol \cdot while the period from May 13 to June 6 is indicated by the symbol $:$. The symbol # indicates the number of bites or occasions when food was taken from the mouth of an adversary. The symbol * indicates the occasions when food was snatched from the immediate vicinity of the mouth of another newt. The symbol ' indicates those occasions when one newt turned away from its intended goal, usually a morsel of food, as another approached it (domination).

Table 2 (five newts, four females, one male) shows that Female *C* tallied four social contacts against the other four before the administration to her of *LSD* 25 and 42 contacts afterward. This represents a 10-fold increase in aggressiveness on the part of Female *C* which appears to be a result of the drug treatment. In contrast, the total number of contacts made by the other four newts against Female *C* before the administration of *LSD* 25 to *C* was 16 as compared with 25 after Female *C* was treated. This represents an increase of one and one-half times in aggressiveness for the non-lysergized members of Hierarchy 2 toward Female *C* after the latter received *LSD* 25.

In Table 3 similar relationships are shown in Hierarchy 3 (comprising four adult newts). It will be noted that the lysergized newt, Female 3, scored nine contacts against her neighbors before receiving *LSD* 25 and 51 after, representing a 5.6-fold increase in hostility as a result of the drug. This is in contrast to the total before and after tallies of the other three newts of 13 and 35, respectively (a 2.7-fold increment) against Female 3.

Table 4 gives evidence relating to four adult males. Results are consistent with those shown in Tables 2 and 3. The scores of Male 4 (*LSD*-treated) against the other three males before and after treatment are 6 : 32, respectively (a 5-fold increase). The tallies of the others against Male 4 before and after the latter was treated are 16 : 41, respectively (a 2.5-fold

TABLE 3
HIERARCHY 3: YOUNG ADULT NEWTS

	♀ 1	♂ 1	♀ 2	LSD"	Totals
♀ 1	#0. *2 '1	#2: *2 '1	#1. *2 '1	#1. *2 '2	#2. *6 '4
					12
♂ 1	#2 *5 '2	#1 *5 '3	#3 *6 '1	#6 *8 '4	#5 *12 '6
					25
♀ 2	#1 *3 '0	#4 *2 '1			#10 *19 '8
					37
♀ 3	#1 *3 '0	#9 *10 '6	#3 *4 '2	#2 *6 '1	#4 *8 '1
LSD"					13
					23
					#1 *7 '1
					#16 *21 '4
					51
					57
					136

" Female 3 immersed in 0.1 mg LSD-25/20 cc water for 2½ hours on May 13.

. Period extends from April 26 to May 13.

: Period extends from May 13 to June 6. Indicated in alternate columns with figures italicized.

Bites or takes food from mouth of another.

* Food snatched from in front of another.

' Dominates another.

TABLE 4
HIERARCHY 4: YOUNG ADULT NEWTS

	♂ 2	♂ 3	♂ 4 LSD"	♂ A	Totals
♂ 2		#1- #4 '2	#2- #5 '1	#2- #4 '0	#5- #13 '3
♂ 3	#4 #2 '2	#9 #3 '0	#3 #2 '0	#2 #4 '0	21 #9 #8 '2
♂ 4 LSD"	#0 #1 '0	#6 #6 '5	#1 #6 '0	#2 #2 '0	19 #2 #3 '1
♂ A	#2 #1 '1	#16 #5 '7	#1 #1 '1	#1 #5 '2	6 #6 #4 '3
					32 #32 #11 '8
					13 51
					59- 147:

" Male 4 immersed in 0.1 mg of LSD-25/20 cc water for three hours on May 13.

• Period extends from April 26 to May 13.

: Period from May 13 to June 6, indicated in alternate columns with figures italicized.

Bites or takes food from mouth of another.

; Dominates another.

* Food snatched from in front of another.

improvement). Note that Male *A* was particularly aggressive in the post-treatment period.

In Table 5 (Hierarchy 5, four juvenile newts), the individual *JE* established three contacts against the other three members of the group before and 37 (10-fold) after being treated with *LSD* 25. The others tallied 16 before and 18 after *JE* was lysergized.

In Table 6 (Hierarchy 6, four juvenile newts), the animal *JJ* scored 13 contacts before treatment and 48 after (3.7-fold increase) against the other three juveniles, whereas the latter tallied 23 before and 14 after *JJ* was immersed in *LSD*.

The mean improvement in aggressiveness of the five newts (Tables 2-6) after immersion in *LSD* 25 was 7.5 times, important statistically at the 0.01 level of significance. The mean improvement of the 16 non-treated newts (Tables 2-6) in the post-treatment period was 1.7 times which was at the 0.02 level of significance (X^2 test).³

The evidence to be found in Table 7 was collected during the interval July 23 to September 16, to show the relationship between size and dominance in juveniles, those which are in the aquatic phase but are immature sexually. Ten aquaria of equal size housed 10 pairs of newts. One member of each pair was observably smaller than the other. During the feeding period the larger of each pair, without exception, dominated the smaller one, by one and/or another of the following social devices: (a) Snatching food from in front of another, designated in Table by *F*; (b) taking food from the mouth of another; (c) biting; (d) threatening approach. Items 2, 3, and 4 are designated by *D*. The total number of social contacts, indicated by the symbols *F* and *D*, for the 10 tanks show that the larger newt of each pair was, on the average, 3.4 times as aggressive as the smaller one.

All 10 of the smaller newts succeeded in snatching food from the vicinity of their larger rivals. Three of these also snatched food from the mouth of a larger newt while the one in Tank 9 actually bit its larger adversary twice and took food by threats four times. This was exceptional behavior for a smaller member of a pair. The larger newts scored a total of 112 *F*'s and 271 *D*'s compared with 97 *F*'s and 15 *D*'s for the smaller specimens. Numerically, the larger individuals were eighteen times as aggressive as the others.

Data are presented in Table 8 to emphasize the effects of hormones and *LSD* 25 upon the aggressiveness of newts in pairs. Into each of seven tanks

³I wish to thank my colleague, Dr. Max Hamburg, for this statistical analysis.

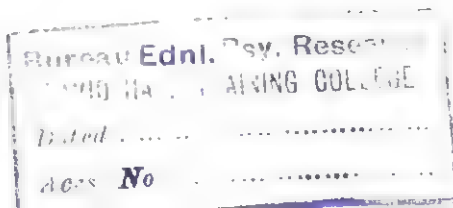


TABLE 5
HIERARCHY 5: JUVENILE NEWTS

	JA	JB	JC	JE LSD"	
JA	#1. #2 '1	#4: #7 '3	#3. #1 '2	#4: #1 '1	#7. #4 '5
JB	#2 #2 '1	#12 #9 '6	#2 #1 '2	#2 #2 '1	16
JC	#4 #2 '0	#3 #3 '1	#7 #3 '0	#2 #3 '0	#6 #5 '4
JE LSD"	#0 #1 '0	#7 #10 '3	#0 #1 '0	#2 #1 '1	15
					#9 #8 '1
					18
					#0 #3 '0
					3
					52.

" Juvenile JE immersed in 0.1 mg LSD-25/20 cc water for two hours on May 13.

Bites or takes food from mouth of another newt.

' Food snatched from in front of another.

, Dominates another.

• Period extends from April 26 to May 13.

: Period extends from May 13 to June 6, indicated in alternate columns with figures italicized.

TABLE 6
HIERARCHY 6: JUVENILE NEWTS

	JG	JJ	JJ LSD"	JK	Totals
JG	#2. *4 '1	#3: *5 '0	#1. *3 '2	*4 #4 '1	#4. *11 '4
JJ	#4 *4 '3	#7 *2 '5	#3 *6 '3	#3 *2 '0	19
JJ LSD"	#0 *6 '0	#3 *7 '6	#1 *5 '1	#7 *6 '3	#10 *12 '6
JK	#2 *3 '0	#4 *1 '0	#2 *2 '1	#0 *0 '0	28
					#1 *11 '1
					13
					#4 *6 '1
					11
					71

" Juvenile JJ immersed in 0.1 mg LSD-25/20 cc water for two hours on May 13.

Bites or takes food from mouth of another newt.

* Food snatched from in front of another.

' Dominates another.

. Period extends from April 26 to May 13.

: Period extends from May 13 to June 6, indicated in alternate columns with figures italicized.

of similar dimensions were placed two so-called juveniles (in the adult phase but immature sexually) of unequal size. Aggressiveness was observed during the pre-treatment period, July 23 to September 16, 1955, and continued during the post-treatment interval until November 7, 1955. On September 16, the smaller animal in each tank was treated thus: Tanks 1 and 5, 1 mg. mammalian interstitial cell stimulating hormone, *LH*; Tanks

TABLE 7
HOSTILITY AS OBSERVED IN PAIRS OF YOUNG NEWTS

Tank	Small		Large	
	F	D	F	D
9.	6	9		
10.	7	0	13	45
11.	19	0	12	32
12.	11	0	5	24
13.	10	0	10	25
14.	7	0	13	24
17.	6	0	12	12
19.	7	4	11	17
20.	11	2	11	33
21.	13	0	10	27
			15	32
Totals	97	15	112	271
		112		383

TABLE 8
EFFECTS OF HORMONES AND *LSD* 25 UPON HOSTILITY OF YOUNG NEWTS
AS STUDIED IN PAIRS

Treat- Tank ment	Small Treated				Large Untreated			
	F.	D.	F:	D:	F.	D.	F:	D:
1. LH	10	0	14	8				
2. TP	11	0	16	14	15	39	8	13
3. LSD	3	0	19	20	13	28	16	23
4. Pit	8	1	15	14	10	30	6	38
5. LH	4	7	20	30	16	28	14	22
6. TP	15	11	20	24	6	29	14	34
7. TP	9	10	21	10	18	14	14	21
					6	31	13	16
Totals	60	29	125	120				
Grand total		89		245	84	199	85	167
						283		252

F—Food snatched from in front of another.
D—Food taken from the mouth of another, dominates another, bites another.

—Pretreatment period, July 23 to September 16.
:—Post-treatment period, September 16 to November 7.

LH—Interstitial cell stimulating hormone; *TP*—testosterone propionate, supplied by Wyeth Co.; *Pit*—whole pituitary, sheep: 1 mg, respectively, administered September 16. Small newt in Tank 3, immersed in *LSD* 25, 0.1 mg/20cc water for two hours on September 16.

2, 6, 7, 1 mg. testosterone propionate, *TP*; Tank 4, 1 mg. whole sheep pituitary; Tank 3, immersed two hours in 0.1 mg. *LSD* 25/20 cc. water.

It will be noted in Table 8 that in the pre-treatment period, the larger animal in each tank was on the average three times as aggressive as the other. After the administration of hormone or drug, however, the larger newt was about 2 per cent more aggressive, numerically. Moreover, the bigger specimens averaged 12 per cent less pugnacious than in the pre-treatment period. The smaller newts, on the other hand, were 270 per cent more overtly hostile after being treated. The greatest increase (13 times) was shown by the smaller newt in Tank 3 (*LSD* 25) in the post-treatment period. The hormone-treated newts were more than twice as aggressive in the post-treatment interval than before.

The influence of body size upon social rank was nowhere better shown than in groups of twos (Tables 7 and 8). In Table 7, although the smaller newt in each tank ranked relatively high in the record for the lesser aggressive trait of food snatching (*F*), it was notably low in hostility as measured by biting, taking food from the mouth of another, or by threatening approach (*D*). These data emphasize the difference between the newt hierarchy (peck- or bite-right) and that of the chicken (peck-order), especially as observed in Tanks 11, 12, and 20, wherein the smaller individuals exceeded the larger in number of *F*-contacts (41 *F*'s to 25 *F*'s). In the other tanks (Table 7), of course, the larger animals reversed this trend. In number of *D*'s, the larger individuals exceeded the others to the extent of 18 times.

In Table 8 an analysis of the data on hormones and *LSD* 25 indicate the following: *LH*—the smaller newts showed 2.4 times and 5.4 times improvement in *F*'s and *D*'s, respectively, after treatment. The larger ones showed 1.04 times and 0.71 times improvement in *F*'s and *D*'s, respectively, in the post-treatment period. *TP*—again the smaller opponents, after treatment, had better aggressive scores, namely, 1.6 times and 2.2 times improvement in number of *F*'s and *D*'s, respectively, compared with 1.1 and 0.82 times improvement in *F*'s and *D*'s, respectively, by the untreated newts. *Pit*—after treatment, the smaller newts were especially affected, showing 1.87 and 14 times reduction in the hostility threshold in *F*'s and *D*'s, respectively, in contrast to the larger untreated specimens which exhibited 0.87 and 0.78 times reduction in hostility threshold in *F*'s and *D*'s in the same period. *LSD* 25—after immersion in *LSD* the smaller newt was 6.3 and 20 times more aggressive in *F*'s and *D*'s, respectively, while the untreated animal had scores of 0.6 times and 1.26 times improvement in *F*'s and *D*'s, respectively.

In brief, the effect upon behavior of the hormones used was to lower the threshold of combativeness in the recipient animals to the extent of 1.95 times and 7.2 times in *F*'s and *D*'s, respectively, while the larger so-called controls in the same period averaged no change in threshold in number of *F*'s and 0.77 times reduction in threshold in *D*'s. The effect of *LSD* was even more effective in lowering the threshold.

Despite the paucity of experimental data the results obtained as shown in Tables 1-8 are more significant than otherwise indicated because the very important factor of bodily size was ever present as a determiner of social rank. The treated newt in all groups represented improved its social status against a weight-size handicap.

E. DISCUSSION

It cannot be denied that the treatments had a positive effect in disturbing hierarchical rank. Ordinarily the rankings of individuals tend to remain stable as shown in Hierarchy 1 and in the paired groups (Table 7). Whether the after effects of treatments as related to aggressiveness were direct or indirect is not known. It has been argued⁴ that these were quite transient. Some psychological change has occurred in the newt which, after recovering from the immediate narcotic influence of *LSD*, has made a former low-ranking individual less submissive, even more aggressive. Having established a higher position in the hierarchy, the treated newt maintains its new social status merely by virtue of the acquiescence of the others in the group. This argument ignores three facts. First, that untreated newts also increased their hostility in the post-treatment phase and hence were not acquiescent (Tables 2-6). Second, a corollary of the first, the more aggressive newt appears to test the social vulnerability of another. Like most animals, these newts appear to recognize intraspecific size relationships perhaps by way of visual cues. Normally, the larger animal dominates. If a newt that has been dominant in a group is suddenly attacked by one (recently lysergized) that had hitherto retreated, the erstwhile "tyrant" increases its aggressive contacts not only toward the rebellious individual but usually toward the others in the group as well. Unless the after-effect of *LSD* is relatively permanent the treated newt would quickly give way before the pressure of hostility. The data indicate that no such breakdown of hostility occurred on the part of lysergized animals. It is therefore con-

⁴The point was discussed when this report was presented at Symposium III, Progress in Neurobiology, The Biological Actions of Psychopharmacological Agents: Mechanisms and Behavior. Hotel Claridge, Atlantic City, June 16-17, 1956.

tured that *LSD* brings about some long-lasting change in the central nervous system which in some way lowers the threshold of aggressiveness. Third, unlike the condition in the barn fowl where social rank is relatively static and where a lower ranking chicken is easily detected because it almost never retaliates toward one of higher rank, newts of lower rank do exhibit some degree of aggressiveness toward those of higher status by gulping food in front of them or by biting. This means that the relationship of members one to another in a newt hierarchy is more dynamic than in the barn fowl. The amphibian in top social position is usually discovered only after a careful check on contacts has been made.

A comparison of the behavior of the lysergized newt toward its neighbors and of their response to it in turn reveal the dynamic social tensions that are present in intraspecific groups. During the post-treatment period, May 13 to June 6, in Hierarchies 2, 3, 5, and 6 the newts which were immersed in *LSD* were from 1.3 to 3.4 times as aggressive toward non-treated individuals than were the latter toward their lysergized rivals. In Hierarchy 4 the reverse was true, namely, the non-lysergized animals were 1.3 times as aggressive toward Male 4 (*LSD*) as he was toward them.

In searching for a possible clue that might explain this unique pattern noted in Hierarchy 4, it became apparent that the average mean improvement in hostility during the post-treatment interval of the normal newts in this group was 2.3 times as compared with the aggressive scores recorded for the pre-treatment period, and 43 per cent as much as the improvement of Male 4. The latter improved 5.3 times after immersion in *LSD*. On the other hand, the average mean improvement of the normal animals of Hierarchies 2, 3, 5, and 6 was 1.2 times (none was above 2.1). This degree of improvement represents just 15 per cent of the improvement recorded by the four lysergized newts of these hierarchies, whose average mean improvement was eight times as compared with their pre-treatment performance. In other words, the hostility that faced the narcotized individual in Hierarchy 4 was twice as severe as that faced by similarly treated newts in the other four groups. Nor was Male *A* the only animal in the group to attack Male 4 (*LSD*). The scores of all three opponents of Male 4 were remarkably similar in hostile approaches and bites. However, Male *A* appeared to bite Males 2 and 3 much more frequently than Male 4 and the lysergized newt may have suffered in retaliation. The data given in Table 4 indicates that Male *A* was the top-ranking individual. It is not known why Male *A* was so markedly aggressive in the post-treatment period unless the drug-induced hostility of Male 4 stimulated Male *A* to his full poten-

tiality. It is possible too, that time was required for the effects of the domination of Female *A* in Hierarchy 1 (from which *A* came) to wear off.

The dynamics involved in Hierarchy 2 are also noteworthy. All these individuals were members of Hierarchy 1 and it would appear that social relations would have been similar to those that existed previously when Female *A* was so obviously the "tyrant." But with the removal of Males *A* and *C* and Female *E*, the social lines were more tightly drawn and now Female *A* was only 1.4 times as hostile as Female *B* and only slightly more so toward any of the others, while in Hierarchy 1 Female *A* was more than six times as hostile. It is significant that after treatment, Female *C* (*LSD*) was definitely more aggressive toward Females *A* and *B*, less so toward Female *D*, than before.

F. SUMMARY

The common eastern newt, *Triturus viridescens viridescens* (*Rafinesque*), was found to be aggressive and when two or more kept together a social hierarchy of the "peck- or bite-right" type developed. Evidence for this combative behavior was most marked during feeding periods. Rivalry was measured in terms of the number of times one newt either snatched food from in front of another (*F*) or took food from the mouth of another or bit another or by means of a threatening approach caused another to turn away (*D*).

The largest specimen in a group was usually found to occupy the highest social rank. Visual cues might have been used by the animals in distinguishing one from another on the basis of size. Under normal conditions the social rank of an individual in a hierarchy was relatively static.

After the individual in a group with the least score in terms of *F*'s and *D*'s (it was usually the smallest also) was immersed in a solution of lysergic acid diethylamide (*LSD* 25), its pugnacity was increased an average of seven and a half times what it had been before the administration of the drug. In the post-treatment period the aggressiveness of the non-treated, larger newts was increased an average of one and seven tenths times.

Such hormones as testosterone propionate (*TP*), interstitial cell stimulating hormone (*LH*), and mammalian whole pituitary (*Pit*) also proved effective in lowering the threshold of hostility.

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A GUIDE TO PUBLISHED LITERATURE RELATING TO THE AUTHORITARIAN PERSONALITY THROUGH 1956*

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A. INTRODUCTION

Few recent works in the social sciences have had an impact upon professional and lay audiences comparable to that of *The Authoritarian Personality*, published in 1950 by Adorno, Frenkel-Brunswik, Levinson, and Sanford (3). A full explanation of this phenomenon must wait for analysis by a sociologist of knowledge or a historian of science. Some evidence of the perceived importance of the original work is indicated by the fact that a book evaluating it has been published (39), that an evaluation of subsequent research has been made (220), and that the relevant publications of one of the authors (Frenkel-Brunswik) are highest in frequency of citations made in *The Journal of Abnormal and Social Psychology* (40).

As often occurs when an essentially new formulation of a basic question is made, the critical attention directed toward *The Authoritarian Personality* has been frequent, intense, and many-faceted. Indeed, it is one of the few books known to have been criticized before it was published (141)!

The literature directly related to *The Authoritarian Personality* is widely scattered and of highly varied quality. Some of it deals with methodological points, some with substantive findings in highly diverse areas, and some with the application of the basic concepts and measurement instruments. The present article is intended as a guide to the published literature in these areas through 1956, so that any person with specific interests can readily find the relevant references. No over-all evaluation will be attempted although summaries of the current status of some circumscribed aspects will be provided when there appears sufficient justification for doing so. The reader will be referred to evaluations that have been published, and more recent references, when pertinent, will be cited.

The present guide is incomplete in several respects. No reference is made

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to unpublished theses or dissertations on the following grounds: (a) knowledge of their existence is incomplete, (b) they are frequently difficult or expensive to obtain, and (c) they are of interest mainly to readers with highly specific research interests. We can make no accurate estimate of the number of such references although it is undoubtedly extremely high (Titus and Hollander's limited review (220) refers to 12 dissertations, 15 abstracts, and 37 published articles and books). Abstracts of papers given in annual meetings of the American Psychological Association (as published in the *American Psychologist*) are also omitted since it is difficult to ascertain their relevance or to evaluate the research on the basis of a short abstract.

The present listing attempts to include all published material directly relevant to *The Authoritarian Personality*. The authors have examined the *Psychological Abstracts* for pertinent references, and have covered the major psychological journals dealing with social and personality psychology. Many articles of peripheral relevance have been found in which scales or concepts stemming from *The Authoritarian Personality* have played a part. Instruments such as the *F-Scale* are so often taken for granted that they are administered routinely in studies which, at first glance at least, have little to do with the original study. We have reason to believe that some such articles have been overlooked since a few have accidentally been discovered since the completion of the search for articles to be surveyed in this paper.

This guide contains, therefore, the known references published in scientific journals in which scales developed in *The Authoritarian Personality* have been used, and those studies in which concepts taken from it have been extended, modified, or criticized.

The studies will be discussed in the following order: (a) Perspectives, (b) Methodological aspects of the *F-Scale*, (c) Social sophistication and the *F-Scale*, (d) Political attitudes, (e) Authoritarian ideology and child rearing, (f) Interpersonal behavior, (g) Authoritarianism, prejudice, and psychopathology, (h) Minority group membership and authoritarianism, (i) Other relations to authoritarianism, and (j) Summary.

B. PERSPECTIVES

The Authoritarian Personality has probably been scrutinized from more points of view than any contemporary work. Interest in it was stimulated by a number of prepublication reports (74, 82, 83, 84, 131, 134).

Other studies by the original authors have followed up implications of the original research. Adorno has discussed mass manipulation (2). Frenkel-Brunswick has reported related research on children (75, 77, 81), percep-

tion (76, 78), and more general considerations (79, 80). Levinson has investigated criminality (132) as well as ideological correlates and other matters (88, 133, 135, 160). Sanford has reviewed subsequent developments (194) and pursued the personality implications of authoritarianism (71, 223).

Among those associated with the original research, Rokeach has ingeniously and persistently elaborated the cognitive aspects of authoritarianism and prejudice (179, 180, 181, 182, 183, 184, 185, 186, 187, 188).

Jahoda (116) has described the background of the research. Himmelhoch (105) wrote an early and influential précis. Lasswell (128) and Shils (200) have raised questions about implications of the work.

Hyman and Sheatsley's methodological critique of *The Authoritarian Personality* (111) is a model of scientific analysis, and is probably the most cited reference in the area aside from the original work itself.

Christie (34) analyzed early research stemming from *The Authoritarian Personality*; Titus and Hollander (220) reviewed some of the studies using the *F-Scale*; and Sanford (194) has recapitulated some of the earlier findings (also see 224). Hood and Sherif (109), and Lindzey (140) have discussed personality-oriented approaches to prejudice.

Stern, Stein, and Bloom (212) have presented extended theoretical considerations which will not be reviewed here. Jacob (115), in his summary of research on changing values in college, devoted considerable attention to Stern's work in addition to that springing directly from *The Authoritarian Personality*.

No such brief summary can possibly indicate the impact of *The Authoritarian Personality* on the social sciences or the educated public. The effect on research is implicitly indicated by the number of related research papers summarized in the following pages.

C. METHODOLOGICAL ASPECTS OF THE *F-SCALE*

The *F-Scale* is one of the most intriguing psychological instruments ever constructed. It is in many ways a psychometric nightmare for measurement purists. On the other hand, it has been found to be correlated meaningfully with a wide variety of important social and personality variables including non-pathological irrationality.

In the initial process of item analysis by means of the Likert technique, a split-half reliability of .90 was attained. This is high enough to approximate uni-dimensionality. In fact Eysenck (66) reported an unpublished factor analysis of some of the original California data by Melvin which

yielded a single factor. This finding, however, has not been replicated and may be an artifact of the sample or the method (35, 36). Unfortunately, most subsequent studies do not report the reliability of the *F*-Scale. It appears, however, to be lower than the initial .90 and to vary from sample to sample. In one report, split-half reliabilities ranging from .34 to .78 were found in different samples on the same 10 *F*-Scale items (38, Table 4).

Christie and Garcia (37) reported a cluster analysis of two matched samples which yielded different patterns of relationships between items. Aumack (10) found another pattern of clusters in a sample of prisoners, and also reported changes in the clusters related to length of imprisonment. These studies were based on all of the original *F*-Scale items.

Four studies have reported factor analyses of some *F*-Scale items mixed with items from related scales. Hofstaetter (107) uncovered five factors in a 20-item pool. (Crutchfield (52) has pointed out that the analysis appears technically faulty, however.) O'Neil and Levinson (160) concluded that the factors cut across the scales they used. Prothro and Keehn (170) reported an analysis of items from the *F* and *T* ["tough-mindedness" as defined by Eysenck (66)] on a Lebanese student sample. Rokeach and Fruchter (188) made an analysis of the *F*-Scale in conjunction with a variety of other measures including dogmatism.

No apparent congruence of the factors uncovered in these studies nor with those in the cluster analysis studies is apparent. Neither do unpublished factor analyses with which we are familiar yield a consistent picture. The patterns of correlations between items on the *F*-Scale appear to fluctuate from sample to sample. This seems to indicate that the *F*-Scale does not tap a psychometrically invariant dimension.

An earlier explanation of these findings was that the *F*-Scale items are often ambiguous, allowing their interpretation to vary from sample to sample. Recent research following lines suggested by Cronbach has pointed to the possibility of response set as a relevant variable, since it tends to operate when items are vague or ambiguous (5, 6, 15, 16, 31, 32, 43, 44, 85, 113, 114, 129, 155, 167, 199). This material has been reviewed by Christie, Havel, and Seidenberg (38) who argued that some of the studies were inadequate tests of response set. A set of reversed *F* items was constructed and item analyzed against the original scale. A new scale consisting of both the reversed and the original items was administered to obtain a more refined measure of response set. Negligible amounts were found in a representative nation-wide sample of adult college-educated persons. The authors concluded that authoritarianism and acquiescence were not identical.

However, they did find a significant amount of acquiescence in a class of college freshmen and related it to a value conflict in the initial year of college between conservative attitudes expressed in home communities and the more liberal college norms.

If this argument is correct it suggests that disparate findings on analyses of the structure of the *F*-Scale may result from the use of college undergraduates, who are inconsistent in their values. The wisdom of employing more adult (and ideologically consistent) samples as a source of data is indicated.

Another implication of the Christie *et al.* analysis has to do with the sometimes incongruent results obtained when the *F*-Scale is correlated with such measures as intolerance of ambiguity or rigidity. They point out that most of the "relatively" high scorers in college samples have scores which can be obtained only by inconsistency of response (by balancing off agree and disagree statements) or are individuals who tend to agree slightly with both *F*-Scale items and their reversals. Such individuals are not prototypes of the "fascist."

Evidence to date suggests that the *E*-Scale is not as subject to response set bias as the *F*-Scale. This is presumably because the items are less ambiguous. A statement referring to the desirability of having a Negro as a boss, for instance, is more specific than an *F*-Scale item referring to the sex life of the ancient Greeks and Romans. Although the *F*-Scale items tend to be more sensitive to response set, the *E*-Scale items are easier to "see through" and thus are more subject to deliberate dissimulation by persons who may be trying to present themselves in a particular light. The *F*-Scale, however, is not entirely free of this possibility. There are few, if any, scales or personality measures which may not be deliberately dissimulated in some degree. Researchers attempt to reduce such falsification by securing adequate coöperation and rapport. On the other hand, techniques to counteract the possible bias of response set are available. Webster (222) has used a measure of response set as a suppressor variable to correct *F*-Scale scores. Christie *et al.* (38) used a discrepancy score based on differences between scores on sub-scales of original and reversed *F*-Scale items to clarify the meaning of a given respondent's score.

Another related methodological problem is the social desirability of endorsing *F*-Scale items. This problem has not been attacked directly, but studies by Cohn (42) and by Sundberg and Bachelis are relevant (216).

It is clear that such technical artifacts need to be considered carefully in evaluating results obtained with the *F*-Scale. Response set and social desira-

bility of items are artifacts which can be corrected for. The lack of unidimensionality is probably an inherent characteristic of the underlying syndrome, although rigorous tests on ideologically consistent samples need to be made to strengthen this interpretation.

D. SOCIAL SOPHISTICATION AND THE *F*-SCALE

In a review of the earlier literature, it was estimated that the correlation between the *F*-Scale and either intelligence test scores or years of education would fall between $-.50$ and $-.60$ in a representative cross-sectional sample (34). There is no new evidence indicating the necessity for a revision of this estimate. Graduate students have lower *F*-Scale scores than undergraduates, the latter lower than high school students (38). Nor is there reason to revise the estimate that *F*-Scale scores will correlate about $-.20$ with intelligence when education is held constant. A variety of more recent findings illuminate the reasons for these correlations.

Stouffer's study of attitudes toward civil liberties (214) afforded clear evidence that there is a positive relationship between education and general liberality of social outlook in the United States. Among the questions he used were some similar to *F*-Scale items. It can be argued that the *F*-Scale is a measure of social sophistication to a much greater extent than originally intended by the authors of *The Authoritarian Personality*.

Relatively few studies have focused upon respondents of low social status. Kornhauser, Shepard, and Mayer (126) noted that auto workers with an eighth grade education or less were more authoritarian than those with more than eight years of education. MacKinnon and Centers (143) found that among working-class occupations, those persons who identified themselves as "working class" were more authoritarian. Farris (67) reported no significant relationships with political attitudes or behavior within a low education sample. It is as yet uncertain what differences on the authoritarian *F*-Scale is most meaningful when employed in middle-class samples. Interpretations of scores in other samples must be cautiously made.

The relation with social sophistication is reflected in still other ways. The scale has been administered in various cultural and environmental settings. Students in the southwest have been found to score significantly higher than those in the west when social background was matched (37). Stern, Stein, and Bloom (212) reported strikingly high proportions of "stereopaths" (their equivalent of the high *F*-Scale scorer on the Inventory of Beliefs) in colleges not outstanding in their devotion to liberal education.

The ability to simulate the scores of other groups may also be taken as an indication of the extent to which the *F*-Scale items are either "indirect" or related to degree of social sophistication. Cohn (42) has pointed out a positive correlation (among undergraduates) between a measure of intelligence and the ability to simulate scores of highly educated people and unskilled laborers. In a variation of this technique, Sundberg and Bachelis (216) administered the *F*-Scale with instructions to respond first as a prejudiced person, and then as an unprejudiced person. Scores were significantly higher when obtained under the prejudice instructions but were not significantly lower under the non-prejudice instructions (this point will be considered again in the discussion of social perception). Another version of this technique was used by Stotsky (213) who found that students made a higher score when taking the *F*-Scale as "neurotics" would, than as "normals."

We cannot know to what extent the *F*-Scale items were indirect to the original sample members reported in *The Authoritarian Personality*. It seems evident that they are now heavily loaded with a factor of social sophistication. When this fact is recognized or controlled, the items need not be invalidated as a measure of personality. Prejudiced or bigoted persons may actually be deficient in social sophistication. Further, the higher scores for "prejudiced," "uneducated," and "neurotic" persons as simulated by college students, may reflect either the tendency to ascribe attitudes which they reject themselves to those persons whom they consider deviant or the fact that the findings of *The Authoritarian Personality* and similar works are a part of the frame of reference of the more intelligent college student.

E. POLITICAL ATTITUDES

It is of some interest to examine the extent to which a scale designed to elicit political predispositions on the personality level relates to political behavior. In two major recent American voting studies, modified *F*-Scale items were used. No systematic differences were found between the scores of Republicans and of Democrats (19, 29).

A factor analysis by Williams and Wright (227) of questions from the Elmira data indicated clearly the lack of relationship between authoritarianism and party preference. The first of the two factors that emerged had its highest loading on items of the *E*- and *F*-Scale types. The second factor was identified by political party, attitudes toward labor, and class identification. The relation between these two factors was studied independently for persons of grade school, high school, and college education, and was orthogonal at each education level. These data were collected dur-

ing the 1948 election which was fought on traditional economic lines of difference between the two parties. A similar analysis of the 1952 election would be useful in examining the invariance between party and authoritarianism under conditions involving more of the symbols related to the first factor.

Janowitz and Marvick (117) and Sanford (192) have noted that *F* scores were positively related to non-voting in cross-sectional samples; education was not controlled in the second study, however. Mussen and Wysznski (158) found no relationship between the California scales and political apathy among undergraduates although some projective tests yielded material interpreted as consistent with *The Authoritarian Personality*.

When political attitudes are divorced from major party membership, consistent differences are found. Milton (156) found high scorers on *F* chose more authoritarian presidential aspirants (Taft and MacArthur) than did low *F* scorers. Gump (98) found high scorers more critical of Truman's dismissal of MacArthur. Simos (204) found *E*-Scale scores related to attitudes toward the Rosenberg case and the Republic of Korea. Handlon and Squier (101) report that graduate students refusing to sign a special loyalty oath at the University of California had lower *F*-Scale scores than did signers although even the latter group had a low mean score relative to most samples.

Paul (162) found no relationship between *A-E* scores of undergraduates and choice of Eisenhower or Stevenson immediately prior to the 1952 election. This is interpreted as not contradicting Milton's findings which were collected before the party nominations and were, therefore, presumably less affected by party identification. Paul carried his study further, however, and compared personality ratings of the candidates made both before and after the election. An interesting *fait accompli* effect was found as predicted; Eisenhower's ratings increased in favorability after election and most especially among the high scorers.

When we turn from the major political parties to those with more clearly defined ideological positions, consistency is found. Christie (34) has presented evidence indicating that adherents of the Communist Party make low scores on the *F*-Scale and that Fascists make high scores. Newer evidence by Rokeach (186) supports this conclusion. Eysenck (66), however, has argued that both Communists and Fascists are high on the *F*-Scale and on a measure called "toughmindedness." The untenability of this position is demonstrated elsewhere (35, 36).

Shils (200) has argued that Communists and Fascists are similar in per-

sonality structure. This may be true in certain respects, *e.g.*, they both give high proportions of extreme responses. However, the *F*-Scale is a measure of *right* authoritarianism, not general authoritarianism (see Rokeach, 186). The most intensive direct study of Fascists has been done by Dicks (57) whose independent investigation corroborates the findings obtained with the *F*-Scale (also see 58, 59).

F. AUTHORITARIAN IDEOLOGY AND CHILD REARING

The authors of *The Authoritarian Personality* had a psychoanalytic approach to the problems of authoritarianism and consequently stressed child rearing practices as an explanation of authoritarian character structure. They were, however, limited in their research on etiology by having to depend on retrospective accounts of child rearing behavior from their subjects. Further, Christie has pointed out that: "The material in *The Authoritarian Personality* indicates that personality factors related to early life history are of importance but we cannot accept the assumption underlying the statistical treatment (of the interview data); we do not know how important they are" (34, p. 193).

A variety of studies lend support to the hypothesized relationships. Jourard (123), Lyle and Levitt (142), Melikian (153), and Stagner (209) have reported results indicating that authoritarianism is related to attitudes toward parents. Levinson and Huffman (133) constructed a scale to measure traditional family ideology and found it correlated $+ .73$ with the *F*-Scale and $+ .65$ with the *E*-Scale. Block (21) and Kates and Diab (124) reported relationships between authoritarianism and child rearing attitudes. Willis (228), in a Swedish sample, reported a relationship between acceptance of strict demands as children, demands for strict obedience on the part of children, and authoritarian political beliefs. The relationship between the last two variables was also found to exist in an American undergraduate sample.

A more direct test was made by Harris, Gough, and Martin (102) who questioned parents of children who had been tested for prejudice by Gough. They found that attitudes of tolerance and good judgment in child rearing on the part of parents are associated with freedom from ethnic prejudice in children. Frenkel-Brunswik (75, 77) reported a similar conclusion after interviewing parents of prejudiced children.

A discordant note in this array of congruent findings is struck by Gallagher (86) who reported no relationship between the *F*-Scale and a scale measuring harshness toward children. Respondents were undergraduates

taking a course in child psychology. No scale means or reliabilities were presented, nor was the scale of harshness reproduced. It is, therefore, impossible to determine the tenability of the findings.

The bulk of evidence supports the hypothesized relationship between strict practices in child rearing and subsequent authoritarian and intolerant beliefs. However, none of the available material appears sufficient for a direct test of Freudian hypotheses. The actual specification of what parent behaviors or combinations of them lead to a higher probability of authoritarianism in children is little advanced beyond the factors noted in *The Authoritarian Personality*.

G. INTERPERSONAL BEHAVIOR

Current interest in problems of social perception is reflected in several studies. Scodel and Mussen (197) had high and low scorers on the *F*-Scale interact with one another for a short period and then fill out the *F*-Scale as they thought their partners had. High scorers assigned responses adding up to scores not significantly different from their own; low scorers filled out the forms for their partners in such a way that the resulting scores were midway between their own scores and those of the high scoring individuals with whom they had been interacting.

Scodel and Mussen's conclusion that low scorers have greater perceptiveness of others is plausible and in line with the theory of authoritarianism. It is not, as Crutchfield (52) has pointed out, established by the results, since the scores might reflect different stereotypes of others rather than accuracy of perception. Scodel and Freedman (196) repeated the experiment and modified the design so that both groups interacted with people having similar as well as differing *F*-Scale scores. The results conformed to those in the earlier experiment with the additional finding that no matter with whom interaction occurred, high scorers attributed scores similar to their own and low scorers attributed scores midway along the scale.

Crockett and Meidinger (50) conducted an experiment similar to that of Scodel and Freedman. It differed in two respects. Half of the discussions prior to making judgments involved radio, television, and movies (as in the Scodel experiments) whereas half involved discussion of child-training practices (a topic presumably central to the genesis of authoritarian attitudes). This made no difference in results. The measure of accuracy also differed since a more refined measure of profile similarity was used in place of total scores. The over-all results were strikingly congruent with those in the preceding studies.

A further variation of this experimental paradigm is reported by Rabinowitz (174) who eliminated experimental interaction altogether. He noted that the above results reflected characteristics of the judges rather than of the subjects judged and postulated that this might indicate differences between high and low scorers in their images of the beliefs of typical college students. After his subjects filled out the *F*-Scale they were asked to fill it out as they believed the typical student in their college would. They systematically overestimated *F*-Scale scores (if the scores of these subjects can be projected to the entire school). The 20 per cent low on the *F*-Scale assigned significantly higher scores compared with their own to the typical student than did the 20 per cent high on *F*. Indeed the low scoring group came fairly close to the group average, whereas high scorers overestimated the typical response.

These studies strongly and consistently indicate that high and low scorers on the *F*-Scale in these samples make quite different assumptions about the attitudes of their college peers. Low *F*-Scale scorers correctly assume that they are different and come fairly close to estimating the mean responses of others, although they cannot accurately differentiate the scores of other individuals on the basis of a brief interaction. High scorers completely misperceive the group norm and are also unable to differentiate accurately among individuals.

The findings in these experiments are not only consistent with those reviewed earlier on social sophistication, they also form a basis for understanding other data involving social interaction.

Siegal (201, also see examples in 202) found that freshman women scoring high on *F* tended toward stereotyping and status-seeking orientation. Marchione and Marcuse (145) report that high scorers on *E* exhibit greater sensitization to a slide of a Negro holding a knife, as shown by better recall. Jones (119) found high scorers on *F* to be more insensitive to personality characteristics in rating an unknown person. Cline (41) found the *F*-Scale was the most highly related personality measure ($-.46$) to accuracy of postdiction of characteristics of subjects who had been filmed during a stress interview.

These studies indicate systematic differences in the judgments by high and low scorers on the *E* and *F*-Scales. It appears in view of the previously cited evidence that this is a function of personality differences on the part of the judges rather than ability to make accurate judgments.

Titus and Hollander (220) have summarized the largely inconclusive results of studies of leadership and authoritarianism. Gregory pointedly re-

marked about such research: "Because military and industrial organizations thus emphasize clear-cut authority (chains of command) there is no reason for believing that they have to choose 'authoritarian' personalities to implement this authority" (96, p. 643; also see 33). Shils (200) has pointed out that most "authoritarian" personalities, by virtue of their very personality structure, are highly unfitted for the exercise of authority in a responsible way.

Masling, Greer, and Gilmore (147) found that naval recruits made more sociometric choices among those scoring low on an "authority acceptance scale" (correlating $+ .59$ with the *F*-Scale).

Although the specifications for successful leadership vary widely from situation to situation, a common requisite is intelligence at least equal to that of the followers. The negative correlation between intellectual ability and *F*-Scale scores indicates a rationale for the negative relationships reported between "authoritarianism" and being chosen as either friend or leader.

When the nature of interpersonal behavior is more carefully specified, the results are more clearcut. McGee (150) set up a rating category system for determining the amount of authoritarian behavior manifested by classroom teachers (reliability of .90). This correlated $+ .58$ with the *F*-Scale scores of the teachers. Leeds (46, 130) reported a scale based on considerations suggested by *The Authoritarian Personality* designed to elicit teachers' attitudes. This scale correlated from $+ .46$ to $+ .63$ with measures of teacher-pupil rapport. Similar findings were reported earlier by Eager and Smith (63) on behavior of female summer camp counselors. These studies were all based on adult-children interaction. A study by Hynes (112) compared teachers' ratings of principals' authoritarian behavior and found no correlations with any personality variables, including the *F*-Scale. It is not clear whether this reflects the more complex nature of structured authority relationships or an inadequate rating system.

Studies of college students in group situations have yielded varied results. Haythorne *et al.* (103, 104) in two well designed studies found significant differences in both the leader and follower behavior of students high and low on the *F*-Scale. Significant interaction effects were also found depending on the composition (determined by *F*-Scale scores) of the groups and the score of the leader. Although Barron (13) did not find the *F*-Scale significantly related to yielding to group pressure in Asch's experiment, Crutchfield (53) did find a significant correlation ($+ .39$) in his more highly controlled experimental variation. Crutchfield (51) also found

high *F* scorers more rigid in a group conflict situation. Wells, Weinert, and Rubel (226) found significantly greater conformity to group pressure among high scorers.

In an ingenious experiment, Thibaut and Riecken (218) found relationships between *F*-Scale scores and aggression toward low status "instigators" in an experiment conducted on Air Force reservists. Block and Block (23) found greater submission to authority suggestion in an experimental situation on the part of high scorers on the *E*-Scale. Finally, Wells, Chiaravalle, and Goldman (225) found a significant relation between ratings of fraternities on an authoritarian dimension and the *F*-Scale scores of their members.

These studies indicate general confirmation of predictable differences in behavior between high and low scorers on the *F*-Scale in interpersonal interaction. The evidence is clearest when there are clean-cut differences in status, as between adults and children, and when hypotheses are tested in an adequate experimental design. Results are ambiguous when "authoritarianism" is confused with the legitimate exercise of authority and when other relevant variables are not controlled.

H. AUTHORITARIANISM, PREJUDICE, AND PSYCHOPATHOLOGY

The relations among authoritarianism, prejudice, and psychopathology constitute a confusing area, if relevant publications are a guide. It is tempting to conclude that the authors of *The Authoritarian Personality* implied certain relationships which their data did not support or that their critics responded to implications rather than to the data. [It was previously noted that Stotsky concluded that college students had a stereotyped notion about the relationship between authoritarianism and neuroticism (213).] Whatever the cause of the confusion, the investigation of clinic patients by Maria Levinson reported in *The Authoritarian Personality* led to the following conclusion, "... one is likely to find people with more or less severe psychological disturbances in the high, low, and middle quartiles (on the *E*-Scale) although we cannot say in what proportions" (3, p. 968). A review of material through 1953 led Christie to conclude "... that the statement about the relationship between personality factors as measured by general scales or inventories and prejudice are of dubious validity" (34, p. 160). However, "... it is possible to develop new modifications of the scales which correlate significantly with measures of prejudice" (34, p. 163).

These tentative conclusions need to be modified in the light of new evidence. It still appears to be true that most measures of "neuroticism" do not correlate with scores on the *F* or *E*-Scales. Here we agree with Masling

(146) but without a clear understanding of why he believed such results to contradict *The Authoritarian Personality*. If the high scorer on the *F* and *E*-Scales is truly anti-intrceptive and tends to repress anxiety it seems theoretically implausible that he would agree to the statements in most neurotic inventories (agreement implying acknowledgment of neurotic symptoms) except through stupidity or an acquiescent response set.

The most cogent evidence relating the *F*-Scale to psychopathology appears in recent articles by Freedman, Webster, and Sanford (71), and by Jensen (118). The latter incorporates material from the Freedman *et al.* article and contains a summary of other relevant material.

Jensen (118) has reviewed results obtained in relating scales of the *MMPI* to the *Pr* [Gough's prejudice scale based on *MMPI* items (90, 91, 92, 93)], the anti-Semitism scale, and the *F*-Scale. College students scoring high on these scales had consistently and significantly higher scores on the following *MMPI* scales: *D* (depression), *Pt* (psychasthenia), and *Sc* (schizophrenia). Negative relationships were found with *K* ("defensiveness") and *Hy* (hysteria), with the highest relationship of all being found with *K*.

Conclusions based on scales of pathology in a sample "normal" enough to be in college must be viewed judiciously. Within such samples, however, a number of respondents display evidence generally indicative of psychological maladjustment (on *MMPI* scales, normalized *T* scores of 70 and above are so interpreted). Of those scoring above this cut-off point on the *D*, *Pt*, and *Sc* scales there were about 12 times as many scoring high on the *Pr* scale (upper seven per cent) as there were scoring low (lower eight per cent) in Jensen's sample. He notes: "The impression is that prejudiced, authoritarian persons have less well developed ego defenses and are thus more exposed and vulnerable to psychological stress, in the face of which they develop toward pessimism, cynicism, low morale (*D*), and psychological isolation (*Sc*), along with more primitive defenses of a compulsive, ritualistic, and schizoid nature (the triad *D*, *Pt*, *Sc*)" (118, p. 310).

An interesting aspect of Jensen's discussion deals with the finding that the *Pa* (paranoia) scale has been found to be negatively correlated with *F*. Freedman, Webster, and Sanford (71) found that this was due to items in the *Pa* scale measuring naïveté and not the persecutory sub-scale. Jensen argued that many persecutory items are not subtle and are not accepted by most students. Among the top seven per cent, however, on *Pr* in this sample, a significantly higher score was found on *Pa*.

At the present time, Jensen's comments about the relationship between

authoritarianism and psychopathology appear justified. "It seems likely that the relationship between mental ill-health and authoritarianism does not hold in both directions. In other words while it may be possible to have any degree of mental illness without showing authoritarian attitudes, it may not be possible to manifest an extreme degree of authoritarianism without being psychologically maladjusted" (118, p. 303). In view of the wide differences in the distribution of *F*-Scale scores in different cultural settings, it seems best to indicate that the "extreme degree of authoritarianism" is best viewed as relative to the total distribution of the scores in the population to which an individual belongs. This is reminiscent of Prothro and Jensen's finding (169) in the South that respondents could be anti-Negro without being anti-Semitic, but that the reverse practically never occurred.

A slightly different aspect of psychological functioning appears in studies of psychotherapy. Barron found the *E*-Scale the best single predictor of improvement in psychotherapy; the correlation between *E* and improvement was a striking $-.64$. *IQ* correlated $+.46$ with improvement, and *E* and improvement correlated $-.34$ when *IQ* was partialled out (14). Other studies support the finding that those high in prejudice are inflexible under psychotherapy. They also indicate, however, the possibility of a curvilinear relationship, with some extreme low scorers not responding as well as middle scorers (62, 100).

It should not be too surprising that some degree of maladjustment is found among those who fully agree with extreme statements such as those on the *F*-Scale (see 3, Table 7 (VII), pp. 255-257). Evidence on the lack of ability to make appropriate judgments about peers (reviewed earlier) on the part of high *F* scorers also seems to raise questions about the level of personal adjustment.

It should be emphasized in conclusion, however, that most of the differences found are but indications of tendencies, and that there are many ways of obtaining a high *F*-Scale score (or being prejudiced) aside from severe personal maladjustment.

I. MINORITY GROUP MEMBERSHIP AND AUTHORITARIANISM

The Authoritarian Personality reported positive correlations between the *E* and *F*-Scales. Hyman and Sheatsley (111) and Christie (34) have discussed some problems in interpreting them. Subsequent research, however, does not require modification of this demonstrated relationship between *F*-Scale scores and prejudice. Recent studies have investigated this relationship in members of minority groups.

Sarnoff (195), in a theoretical analysis, viewed Jewish anti-Semitism as identification with the aggressor, and majority group anti-Semitism as a symptom of projection. Adelson (1) developed a scale of Jewish authoritarianism which correlated $+.67$ with the *F*-Scale. His findings are interesting in several respects. Persons who were least affiliated with Jewish organizations (who were not fraternity or sorority members, had no religious affiliation, and did not attend services) scored lowest on the scale of Jewish authoritarianism. The relationship was not linear, however, since Orthodox members scored lower than Reform; those with regular attendance at services lower than those who attended only on holidays; and Hillel and Zionist group members lower than fraternity members. Thus, both those who rejected all Jewish affiliations and those with most complete Jewish identification tended to reject the authoritarian items. Students with one or more foreign-born parents had lower scores than those with both parents born in the United States. Politically liberal students scored lower than those who were politically conservative. Adelson noted that the scale measures "... the attitudes of a group which, because of its uncertain social position, stresses conformity to a particular array of middle-class norms" (1, p. 485).

Himmelhoch (106) reported that the *E*, *F*, *M* (minority group), and *PEC* (political economic conservatism) scales were interrelated within a Jewish college sample. He concluded that with greater self-rejection there was greater generalized ethnic prejudice. Radke-Yarrow (175) found that anxiety about, and sensitivity to, minority group membership increased with age. In another study she and Lande (176) reported that Jewish high scorers on the *F*-Scale were more anti-Semitic than low scorers, and also showed greater avoidance of group identification. Brown and Brstry (26) found more decrease in *F*-Scale scores during college among Jewish than among non-Jewish girls.

Authoritarianism has also been studied in Negro groups. Grossack (97) reported greater hatred of self and hatred of group among Negroes who were high authoritarians. Prothro (173) believes that discrimination results in more marked authoritarianism among its victims than among those who discriminate against them. Neither report, however, cited questionnaire results. Greenberg, Chase, and Cannon (95) found that Negro high school students made higher *F*-Scale scores than White students in the same West Texas town. It is difficult to determine whether this is due to the educational differences occurring when segregated facilities are provided or whether it demonstrates Prothro's point. Using a scale of attitudes toward integration, Greenberg, *et al.* also reported that Negro students with high *F* scores

viewed integration more favorably than those with low scores. The reverse relationship existed among the White students. (These correlations were low, however, and only one was significant.)

Steckler (210) found that students in several Negro colleges scored higher on *F* than reported samples of White college students. Of interest are the relationships reported between the *F*-Scale and two scales constructed for the study—one consisting of anti-Negro items and one of anti-White items. Correlations between the *F*-Scale and the anti-Negro and anti-White scales were $+.57$ and $+.55$ respectively. The correlation between these two scales was significantly positive; and each was also positively correlated with the *E*-Scale (from which items about Negroes had been omitted). The distributions indicated that response set did not contribute significantly to this generality of antipathy to various ethnic groups.

The studies of both Adelson and Steckler indicate that the highly authoritarian minority group members (among those college students sampled) tend to view prejudice toward their group as a consequence of the deviant behavior of members of the minority itself. They apparently tend to conform to the conventional values of the majority group middle class. As marginal individuals, their hostility seems to be directed toward both majority and minority group members.

J. OTHER RELATIONS TO AUTHORITARIANISM

The scales derived from *The Authoritarian Personality* have been employed in an overwhelming number of studies. Among the relations not discussed earlier, the scales or modifications of them have been correlated with or in some way tested against the following variables:

The Aggageddi test (54); agreement with the position of the Catholic church (161); the Allport-Vernon scale of values (65); anxiety as measured by the Taylor scale (54, 55, 120, 201), and by the Elizur method of scoring the Rorschach (153); anomie (179, 208); aphorisms (31); an authority acceptance scale (147); and the autokinetic phenomenon (22, 25, 217).

Body-image boundaries (69); attitudes toward the church (169); cognitive maps (181); complexity-simplicity in art (12); concreteness of thinking (183); custodial ideology in mental hospitals (88); decision-location test (136); distortion in recall (185); discussion leadership (99); dogmatism (186); and dreams (152).

Ego-strength (11); emotional attitudes of former Soviet citizens (18), factors *STDRC* (207); food aversions (206); *GAMIN* (112); group problem

solving (149), group psychotherapy (164); Horowitz faces test (using Mussen's scoring) (148); hostility—manifest (203), and using the Elizur method of scoring the Rorschach (203); ideological militancy (60); and intellectual conviction (187).

Leaders' human-relation-mindedness (151); masked sound (125); moral indignation (123); misconceptions scale (136); misanthropy (215); Mc-Reynolds Concept Evaluation Technique for the Rorschach as modified by Eriksen (55); narrow-mindedness (182); need achievement (5, 6); opinionation (186); particularism-universalism (157); perceptual accentuation (198); perceptual reaction test (199); Pragnänz (68); problem situation test (142); projective pictures (193); and a psychosomatic inventory (55).

Re-enlistment intent of military personnel (151); reversals on the Necker cube (121); rigidity—as measured by the *Einstellung* water-jar-problems (7, 27, 72, 89, 139, 180, also see 137), by the Rorschach (64), by the Wesley scale (229, 230), by the Gough scale (66), and by a test of personal habits (154); rôle conflict (87); and Rotter Incomplete Sentences (146).

Self-concept (163); stability of self-concept (28, 49); sentence completion (61); social acquiescence (16); social causality (219); social distance in Lebanon (172); socialized medicine (144); status anxiety in California (47); stereotypes (190), stimulus generalization in nurses (8); and syllogisms (159).

TAT (77); teaching experience (122); tolerance of trait ambiguity (211); *USC* Parent Attitude Survey (124); Walk's ambiguity scale (124, 159); work camp experience (178); world-mindedness (191, 205); xenophilia (165, 166); and Xenophobia (30).

K. SUMMARY

The numerous and amazingly heterogeneous researches derived from *The Authoritarian Personality* yield a clear picture in the main but an ambiguous one in many details. In broad terms the authoritarian syndrome reflects adherence to values which run counter to those accepted by liberal and literate citizens of the United States. This is indicated by the consistent high negative correlations between the *F* and *E*-Scales and measures of social status. When status is held constant, differences between individuals reflect personality differences in middle-class samples, with those high on the syndrome giving evidence of disturbance in interpersonal relations.

The confusion in some of the subsequent research may result from the very complexity of the authoritarian syndrome, and the theory underlying

it. The research hypotheses examined in many of the later studies bear little apparent resemblance to the original formulations. In many cases the *F* and *E* scales have been used uncritically or naïvely. It is perhaps inevitable that research will be uneven when a complex and affectively charged subject is being investigated. It might equally well be pointed out that some of the research is of exceedingly high quality.

This unevenness in theoretical sophistication makes the evaluation of reported research very difficult. A further difficulty is the frequent failure to observe the basic canons of scientific reporting. In many instances no details of the measures are given; even more frequently basic information on the distribution of scores is not presented. It is rare to find a statement of the reliability of measures. Too often it is assumed that a scale which was satisfactory in California middle-class samples in the mid-forties is equally reliable in a quite different sample more than a decade later.

Although there are serious problems in evaluating research, the over-all picture shows consistency of findings in many of the more intensively studied areas. The *E* and *F* scales are found to be significantly correlated in a wide array of samples and predictions of relationships with attitudinal measures are almost invariably confirmed. Studies in such areas as interpersonal perception lead to theoretically meaningful conclusions and represent a real advance of knowledge in the past few years. Studies in areas such as parent-child relationships show a high degree of agreement if not always at a highly rigorous scientific level.

On the other hand, factors such as rigidity and intolerance of ambiguity have not been unequivocally related to the authoritarian syndrome. This may be because the factors are not conceptually clear and validly measured, or it may reflect a lack of relationship.

Despite all these qualifications it is apparent that the concept of the authoritarian personality has been a powerful and fruitful one. The research surveyed above has led to greater specificity in understanding both the virtues and limitations of the original work. Interest in the area continues at a high level and it is hoped that this guide will be useful to those who desire to obtain an overview of recent work or to locate research relevant to specific topics.

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THE MAGNETIC BOARD RATING TECHNIQUE*

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A. INTRODUCTION

The investigator of public opinion is in a constant search for better instruments for the measurement of public opinion. Among the many problems confronting the investigator are the type of questions to be asked, the type of sample to be selected, the accuracy of responses, and the large amount of information to be obtained within a relatively short time. This report is concerned primarily with the latter two problems.

In a survey of the status and prestige and job satisfaction of 400 professional people employed in state institutions and in private agencies, hospitals, public schools, and private practice, the authors were confronted with the task of eliciting a large number of responses within a short period of time. The responses to be elicited were: status *attributed* to 22 sub-professions, status attributed to one's own and other professions from an *ideal* point of view (where do they deserve to be), the *importance* attached to eight factors of job satisfaction, and the subjective feeling of *supply* of these eight factors of job satisfaction. This information was required in addition to two questionnaires, one consisting of objective indices of status, such as age, income, sex, etc.; and a second assessing job satisfaction.

Since it was expected that many of the professional interviewees, especially physicians in private practice, would not contribute more than 20 or 30 minutes of their time for the purposes of the interview, it became necessary to devise a technique which would measure these variables accurately, simply, and efficiently.

B. DESCRIPTION

The instrument devised and referred to as the "magnetic board" consisted of (a) a 19" x 24" light *steel board* on which two identical vertical scales, ranging from 0 to 100, were drawn, one in the center of the board, the other on the left side. A piece of dark cloth was attached to the board so that it could be folded over the board to cover the center scale. The zero points

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on both scales were labeled "no professional status at all"; the 100 points were labeled "profession with highest possible status." (b) A set of 22 professional titles printed on clear plastic, each fastened to a small magnet, 7/16" x 7/8" x 1/4."¹ The plastic labels were pointed on both ends so that they could be placed on either side of the scale. All of these magnets were placed in random order on one side of the board.

For the measurement of the importance and the subjective supply of various factors of job satisfaction, a second board, 11" x 14", with a single vertical scale was used. Eight factors of job satisfaction were printed on labels with magnets described above and placed randomly on one side of the board. The factors were: *intellectual stimulation, pay, status and prestige, to have regular work hours, security, patient's (student's) respect, freedom in your work, and to have the type of patient (student) with whom I prefer to work.* The subjects placed these factors first according to their importance, and then according to the extent that each was supplied by his present position.

C. INSTRUCTIONS USED

The instructions used in our survey consisted of the following:

I have here a magnetic board and a set of professions. Hold it on your lap and lean it against the table. In the center of the board is a set of numbers that ranges from 0 to 100. These numbers stand for the amount of status and prestige. Zero means no status whatsoever; 100 means the greatest amount of status and prestige. I'd like you to place the professions beside the numbers according to the amount of status that each profession has. Begin by asking which profession you think most people would select as having the greatest amount of status and prestige. Take that profession out and put it beside the number that you think *the general public* would give it. Remember, 100 means the greatest amount of status and prestige that any profession has.

Now I want you to take the profession that *the general public* would choose as having the lowest status and prestige. Place it beside the number that *the general public* would give it. Remember, zero means no status at all.

Now, go on and place the rest of the professions where *the general public* would place them. Please remember, place the professions as *the general public* would do, rather than your own personal way of placing them. If you think that two or more professions are equal in status, place them beside each other. You may place them on both sides of the scale. Try to make the points touch the line.

¹In order to reduce the end effect, the titles of U. S. Supreme Court Justice and hospital attendant were added to the 20 basic titles. Both of these titles were chosen almost invariably as having highest and lowest status, respectively.

When the interviewee finished placing all the professions, the interviewer recorded the scale values of the interviewee's specialty and other sub-professions to be re-rated and transferred the interviewee's specialty to the second scale at the same scale value. He then covered the first half of the board with the cloth.

The interviewer then proceeded with the following instructions:

This is the same scale as the one I just covered. Zero means no status at all; 100 means the greatest amount of status that any profession has. Previously, you placed the profession where you thought *the general public* would place it. Here is where you placed your own specialty (pointing to specialty on second scale). Now, I'd like you to place it where you think *your profession* would place your particular specialty.

The interviewer recorded the obtained value and returned the magnet to the original position and proceeded with the following instructions:

Now I'd like you to place your specialty where *you yourself* think it should be. That is, place your specialty where, in your opinion, it deserves to be.

The interviewer recorded the obtained value and returned the magnet to the original position and proceeded:

This is where you placed your specialty according to the general public. Now, I'd like you to place your specialty where you think *other professions* place you.

The interviewer recorded the obtained values. The procedure is repeated for a number of professional reference groups, with the interviewee's own specialty returned to the original position after every question. After the completion of the first part, the interviewer removed the interviewee's own specialty from the board altogether, and took out the next profession and placed it on the second scale value and gave the following instructions:

This is where you placed the other profession according to the general public. Now, I'd like you to place the other profession where, in your opinion, it deserves to be.

The interviewer recorded the obtained value, removed the profession from the board altogether, and took out the next profession and placed it on the second scale on the same scale value and repeated the instructions for a number of professions.

After the entire scaling procedure was finished, the interviewer proceeded by saying the following:

Now I want you to take the second board that I have here. On this board you will find eight factors that may be important in a person's work. I want you to place these factors beside the numbers according to their *importance* to you. One hundred means the greatest amount of importance; zero means completely unimportant.

The interviewer recorded the obtained values, rearranged the factors randomly, and proceeded as follows:

Previously, you placed these factors according to the amount of importance. Now, I want you to place the factors according to *how much you get* in your present work. Now, let one hundred mean getting it the most, and zero, not getting it at all.

D. RELIABILITY

The reliability data on the magnetic board technique consists of test re-test correlations, administered 10 to 12 weeks apart to 16 subjects of various professions. Since two different boards were used, the correlations were computed for each board separately. The first board was 19" x 24", had 22 stimuli (titles of professions) which were judged for status and prestige. The test re-test correlation on this board was .998 using the means of 16 people. The median individual test re-test correlation was .92.

The second board was 11" x 14", had eight stimuli consisting of factors of job satisfaction, which were judged twice, once for their importance and the second time for their supply to the subject. The test re-test correlation in the judgments of importance was .82 and for the supply .91 using the means of the same 16 people. When using a supply less importance score, the test re-test correlation went up to .94.

It should be added here that the first testing situation for both boards was not identical with the second testing situation in that there was a decrease in the number of stimuli, and also a change in the stimuli themselves (for example, physician, public health, was changed to physician, health department).

E. RATING VERSUS RANKING ON THE MAGNETIC BOARD

Rank order and Pearson correlation coefficients were computed to determine the relationship between mean status assigned to 10 sub-professions by 360 judges² and the mean income of the 10 sub-professions. If the assumption can be made that income is an objective criterion of professional status, then the larger correlation would indicate higher prediction of professional

²This excludes status ratings given to own specialty.

status. The rank order correlation coefficient was .81, the Pearson correlation coefficient .94. Since the rank order correlation coefficient must exceed the Pearson correlation coefficient to equal it in significance, and the opposite was true here, it can be assumed that the rating method gives higher prediction. Thus, while the magnetic board rating technique makes assumptions of equality of intervals and normality of distribution, etc., which may or may not be justified,³ the method apparently has the pragmatic sanction of higher prediction.

A similar result was obtained in the computations of the test re-test reliabilities, where Pearson correlation coefficients based on ratings exceeded rank order correlations.

F. COMPARISON OF THE MAGNETIC BOARD TECHNIQUE TO OTHER TECHNIQUES

In order to determine the comparability of the magnetic board rating technique to other popular techniques, additional data were gathered on the status of 20 occupations selected from the North-Hatt scale (2) using six different techniques (1). The techniques were (a) paired comparison, (b) Likert, (c) Thurstone's equal appearing intervals, (d) the magnetic board, (e) a graphic rating technique, and (f) ranking technique. These data were collected on 80 judges consisting of elementary sociology students. The intercorrelations between any two techniques ranged from .982 to .997. Similar results were obtained with respect to reliability comparisons. The magnetic board had a reliability for mean scale value of .99, and for one judge of .85. On the basis of the additional data gathered, it was concluded that the magnetic board technique is comparable to any of the other techniques with respect to its precision of scale values and its reliability.

G. ADVANTAGES AND DISADVANTAGES

In generalizing about the magnetic board rating technique as experienced by the authors, it can be stated that the technique was found to be simple, speedy, and appealing to the subjects. Among the advantages of the board are the possibilities of: choosing the number of stimuli to be presented at a time, constant readjustment of the stimuli by the subjects, repeated use of the same stimuli according to different instructions, and equality of stimuli for more than one or two stimuli.

Among the disadvantages of the magnetic board technique is the fact that

³Some of these assumptions are being tested now.

it is not self-recording,⁴ and that it is bulky and somewhat more costly than a questionnaire. The instructions for the use of the magnetic board technique must make certain that the subject uses both sides of the scale, that he knows how to place many stimuli on one point of the scale if he desires to do so, and that the subject rates rather than ranks the stimuli.

Due to the fact that the basic technique can be adapted to a multitude of stimuli, the technique lends itself to various types of research. It can be used individually or in groups.⁵ It does not require the use of pencils, and it does not require desk space, since the subjects place the board on the lap, leaning it against any solid object. The technique is appealing to the subjects. It seems especially useful in interviews with very busy people who will not give much of their time for an interview. For studies employing the magnetic board technique see (1, 3, 4).

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⁴The instrument can easily become self-scoring simply by attaching a sheet of paper to the board on which the stimuli are recorded, thus enabling the interviewee to record the values, following his placing of the stimuli.

⁵In the study of status and prestige, the authors administered the technique individually, while in the gathering of additional data to determine the comparability of the magnetic board technique to other popular scaling techniques, the magnetic board was group administered.

BODY IMAGE BOUNDARIES AND SEXUAL BEHAVIOR*

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A. INTRODUCTION AND PROBLEM

In the course of previous work (4, 5, 6), the writers have focused upon the important part that the individual's concept of his body (body image) plays in influencing his behavior. Particular attention has been devoted to one special dimension of body image, viz., the manner in which the individual pictures his body boundaries. It was shown that persons differ considerably in the degree to which they conceive of their body boundaries as definite and firm as contrasted to weak and indefinite. A method was developed for measuring boundary definiteness which was based on the characteristics ascribed to the peripheries or bordering contours of ink blot percepts. Individuals with definite boundaries were found to ascribe enclosing, protective, and barrier qualities to the peripheries of their percepts. Thus, they gave an unusual number of responses of the following sort: knight in armor, fort with rocky walls, cave, mummy wrapped up, and turtle with a shell. The scoring system for evaluating boundary definiteness was devised so that it could be applied to the typical Rorschach protocol. Each response in an individual's Rorschach with special boundary connotations was tabulated and the total number of such responses constituted his "Barrier score." It has been shown elsewhere (5) that the Barrier score can be determined with satisfactory reliability and that it correlates significantly with other measures of body image boundary definiteness.

The correlates and implications of the body image boundary dimension have been explored in a wide range of studies (4, 5). It has proven itself to have value in clarifying such diverse phenomena as site of psychosomatic symptomatology, level of aspiration, ability to tolerate stress, and patterning of physiological reactivity. However one of the main findings that has emerged concerning the difference between definite and indefinite boundary individuals has to do with ability to relate personally and intimately to others. Data have been obtained which indicate that definite boundary individuals

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are "person" oriented rather than "thing" oriented. In group situations they warm up quickly to others; manifest a lot of spontaneity in expressing feeling; and are usually perceived by the other group participants as positive and constructive in their intent. Individuals with indefinite boundaries are relatively more "thing" oriented. They seem to be rather uncomfortable about close intimate contacts. They are inclined to structure personal interaction as much as possible by means of rules and limits; and apparently seek to avoid really free exchange of feeling. There have been indications also that they (low Barrier) have more difficulty than definite boundary (high Barrier) individuals in establishing satisfactory relationships with their spouses and children.

In considering the contrasts between high and low Barrier individuals as to their mode of relating to others, the question arose whether they might manifest differences in such an area as sexual behavior. That is, if one views sexual behavior as exemplifying one of the most intimate modes of personal interaction, it might be expected that the high Barrier person would be more sexually expressive and more spontaneously interested in sexual contacts than the low Barrier person. The present paper is concerned with an attempt to test such an hypothesis. It is, of course, extremely difficult to evaluate straightforwardly an hypothesis which involves sexual behavior. Only under unusually favorable conditions can most normal individuals be motivated to reveal much about their sexual activities. However, a fortunate opportunity was provided for testing the hypothesis in terms of data which had already been collected by Epstein and Smith² (2).

B. PROCEDURE

Epstein and Smith carried out a study which was primarily concerned with the relationship of projective measures of sex drive to other measures of sex drive. In the course of the study they obtained group Rorschach protocols; and so it was possible to score the protocols to establish the Barrier score of each subject. The measures concerned with sexual response which they obtained and which we utilized were of the following order:

1. *Need Sex*

This measure was derived from stories given by subjects to eight *TAT* type pictures. Epstein and Smith describe it as follows:

"This score was adapted from the Murray scoring system (7)

²We acknowledge with gratitude the kindness of Dr. Seymour Epstein in making the data available to us.

Need sex is defined as the need 'to seek and enjoy the company of the opposite sex. To have sexual relations. To fall in love, to get married' (7, p. 10). A basic weight of 1 was assigned to the slightest indication of romance (e.g., 'They are man and wife'), of 2 when a direct reference to romance was made or when some secondary physical contact was indicated (e.g., 'They love each other.' 'He would like to kiss her'), and of 3 when sexual intercourse was implied (e.g., 'She has become pregnant, and they are wondering what to do'). The basic weight was then modified by taking into account centrality, frequency, and duration."

2. Sex Drive Questionnaire

A questionnaire was administered to subjects under circumstances where they thought their responses were anonymous and could not be identified. They were to respond to three check lists which requested "(a) day of last orgasm, with a range of 'today' to 'more than seven days ago'; (b) average rate of orgasm during the past two months, with a range from 0 to 22 or more times per week; and (c) subjective rating of sex drive at the moment, with a range from 'no sexual desire at all' to 'intense sexual desire'."

3. Ratings of Pictures

Subjects were also asked "to rate on a 5-point scale the sex appeal of three women whose pictures were successively projected on the screen. The first was of an attractive young woman in a bathing suit; the second was of a woman in a night gown who was lying seductively on a bed; the third was of a model wearing a low cut dress."

The subjects were 59 men in an introductory psychology class at the University of Massachusetts. Only 53 of the group were used in the present analysis since it was necessary to eliminate six subjects with Rorschach protocols containing 12 responses or less from which valid Barrier scores could not be determined.

C. RESULTS

A chi-square analysis indicates that the differences between above median and below median Barrier score subjects relative to the various sex scores fall generally in the predicted direction. As shown in Table 1, the high Barrier subjects obtained significantly higher *TAT* need sex scores and orgasm rate scores than the low Barrier subjects. The above median Barrier subjects also tended (not significantly) to be higher in orgasm recency scores and picture rating scores. There was no difference at all between the groups so far as the subjective ratings of sex drive is concerned. Generally, the definite boundary subjects appear to be more sexually active and expressive

TABLE 1
CHI-SQUARE ANALYSES OF DIFFERENCES IN VARIOUS SEXUAL INDICES BETWEEN HIGH
BARRIER AND LOW BARRIER SUBJECTS

Sex scores	Group with higher score	Level of significance
TAT need sex	H.B. ^a	.05-.02
Orgasm rate	H.B.	.05
Orgasm recency	H.B.	N.S. ^c
Subjective rating of sex drive	N.D. ^b	
Picture ratings	H.B.	N.S.

^aH.B. = High Barrier.

^bN.D. = No difference.

^cN.S. = Not significant.

than the indefinite boundary subjects. It should be parenthetically noted that the two sex scores (*TAT* need sex and orgasm rate) which gave the most significant results are those which also proved most consistently meaningful within the context of the Epstein and Smith study.

D. DISCUSSION OF RESULTS

The results provide further support for the viewpoint that the more definite an individual's body boundaries the greater his freedom to enter into intimate relationships and have expressive experiences. Of course, this support grows out of the presumption that the sexual behavior indices used by Epstein and Smith provide at least indirect information about the individual's ability to have satisfactory sexual experiences. This presumption stands or falls on the basis of such questions as whether the subjects' self reports of sexual behavior were accurate; whether frequency of orgasm is a reasonable index of ability to obtain sexual satisfaction; and whether samples of sexual fantasy elicited by a projective test are significantly linked with actual style of sexual behavior. The questions posed cannot really be answered on the basis of our present limited knowledge in this area. One is struck, though, by the fact that there is a fair amount of internal consistency in the pattern of results that was obtained. It is also rather noteworthy that both the orgasm frequency measure and the sex need measure which were secured from entirely different kinds of data should both give significant results in the same direction.

There is considerable potential value in establishing a link between the boundary definiteness dimension and patterns of sexual behavior because there has in the past been little or no success in finding empirical correlations between broad psychological constructs and measures of sexual behavior. The body image construct has already been intensively formulated not only

in terms of empirical data but also in terms of its theoretical implications. The significance of degree of body image boundary definiteness has been explored at many levels which are exemplified in such diverse variables as trait patterns, modes of physiological reactivity, socialization experiences, and sensitivity to stimuli. If the Barrier score were found to be consistently related to indices of sexual behavior, there would then be provided numerous leads concerning other psychological and physiological measures which might be predictive of sexual behavior.

In any case, it is clear that the present results must be viewed as tentative and exploratory and in need of further confirmation.

E. SUMMARY

Previous work by the writers had established that the more definite an individual's body image boundaries the greater his capacity to enter into intimate expressive relationships. It was hypothesized on this basis that subjects with definite boundaries would show evidence of greater sexual interest and expressiveness than subjects with indefinite boundaries. The hypothesis was supported by data representing various indirect indices of sexual behavior.

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FIGURE-GROUND PHENOMENA IN THE PERCEPTION OF PHYSICAL AND SOCIAL STIMULI*¹

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A. PROBLEM

Is the process by which we perceive other persons really parallel to that by which we perceive physical objects? A positive answer to this question has been implicitly assumed by experimenters on a wide range of topics over the past 10 years. Unfortunately, the empirical support for this assumption has been scanty. The present study was designed to focus explicitly on a well-explored dimension of physical perception and to determine its relevance for social perception.

The aspect chosen was the figure-ground phenomenon. This seems to be a basic feature of perception of the physical world; it has been extensively studied (15, 25, 26); it has been shown to have relevance for more general aspects of personality (18, 23, 25); and methodology for studies of physical figure-ground phenomena is well developed (13, 15, 17, 23, 25, 26).

There are two important distinct approaches to such a problem. One is focused on the characteristics of the stimulus: e.g., it is necessary to establish that variations in the ground result in modification of the perceived figure, and to analyze these as phenomena of "human nature in general." The second approach, which we take here, focuses on individual differences in susceptibility to figure-ground influence, in the manner developed by Witkin (25). Briefly put, the present investigation seeks answers to the questions: What figure-ground interactions can be observed in social perception? Do individuals markedly affected by context in physical perception show similar effects in social perception? In choosing the latter approach we have also chosen to explore the relation of perceiving to a more general

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¹The data reported here are taken from Rudin (12), a thesis submitted in partial fulfillment of the Doctor of Philosophy requirements at the University of Illinois. A microfilm copy of the complete manuscript is available from University Microfilms, Ann Arbor, Michigan, for \$1.88. Order Publication No. 15,260 giving title and author.

aspect of personality, "authoritarianism" as measured by the *F*-Scale. This test has already been shown to have some perceptual correlates (1).

B. METHOD

We are concerned with measures of independence of figure from ground. Using the logic of Cronbach and Meehl (6), we seek to justify the construct "field-dependence" by establishing significant correlations among the various tests employed. Three tests of physical object perception and two tests of social perception were employed.

1. Measures of Physical Object Perception

a. Embedded Figures (EF) Test. Thurstone's version (24) was used. It presents *S* with a simple geometrical design, then requires him to indicate whether this design is "hidden" in any or all of a set of five more complex designs. Eighteen such items are presented with a five-minute time limit.

b. Rod-Frame (RF) Test. Described by Witkin (25), this test consists of a luminous frame 42 inches square and one inch wide with a luminous rod 39 by two inches in the middle of it. *S*, seated nine feet away in total darkness, must make the rod vertical to the floor of the room by turning a knob near him. *E* tilts the frame in various positions off vertical. This procedure requires the subject to disregard the distracting ground of the frame and to align the rod with the somesthetically perceived gravitational vertical.

c. Brightness Contrast (BC) Test. Based on the fact that a shade of gray looks lighter against a dark background and darker against a light one, this test was devised by Moffitt (13) after one suggested by Klein (9). *S* is shown a series of 4-inch square gray cards with a small 1-inch square patch of another shade in the center. He is required to match the gray of the center square to one of a series of standards of varying shades. In all, 14 shades of gray at approximately equal-appearing intervals were used. The score was the number of such steps between the reported brightness and the "physically real" brightness of the stimulus square.

2. Measures of Social Perception

Because the social perception tests were devised for this study, they will be described in more detail. Reproductions of the stimuli used are given in Rudin (19).

a. Picture Contextual Influence (PCI) Test. In devising this test,

graphic representations of persons were used. While it is feasible to use living individuals as stimuli, control and manipulability are seriously limited. It seems likely that pictures of persons evoke at least an important fractional part of the response to a "real" person.

For the *PCI* test, stimulus materials were adapted from the *MAPS* (Make-A-Picture-Story) Test (21). *Ss* were asked to describe various figures placed against different backgrounds. Responses were standardized by having *Ss* rate each figure against each background on 15 paired-opposite rating scales from Osgood's (14, 15) semantic differential test: viz., strong-weak, honest-dishonest, active-passive, ferocious-peaceful, good-bad, rugged-delicate, fast-slow, kind-cruel, happy-sad, heavy-light, brave-cowardly, calm-agitated, hard-soft, beautiful-ugly, relaxed-tense. The figures were: M-15, young man; F-1, nude woman; C-8, boy; C-1, girl; and these figures with blank faces: S-2, young man; S-3, young woman; S-4, boy; S-5, girl. M-15's mouth was drawn into a smile and F-1 was covered with a drawn paper dress to de-emotionalize the figures. The backgrounds were: living room, woods, schoolroom, and street corner.

b. Self Contextual Influence (SCI) Test. This test is based on the assumption that the self is perceived as a social object, as argued by theorists such as Snygg and Combs (22) and Lewin (11).

S was presented with a booklet, the face sheet of which explained the use of the rating scales in describing a person. Each of the following four pages described a situation and requested *S* to imagine himself in that setting, then to describe himself on the rating scales as he thought he might be in that situation. The situations were rough descriptions of those of the four *MAPS* backgrounds. Rating scales were the same as for the *PCI*.

c. Scoring the social perception tests. In the case of both measures the sets of ratings were compared with one another with respect to similarity by means of the statistic *D* (5, 16). Larger values of *D* indicate greater dissimilarity. To obtain the *SCI* score, each of the four sets of ratings derived from each of the four situations was compared with each other, giving a total of six *D*-scores. Since it is obviously indefensible to assume that any one of these scores is more valid than another, all six were summed to give an index of variability in self-perception.

The *PCI* test score was similarly obtained, with one additional step. Since there were eight figures, with four sets of ratings (one from each background) for each figure, a score similar to the *SCI* score was obtained for each figure separately by comparing the ratings for each of the four backgrounds, then summing these six *D*-scores. Finally, the scores for all eight

figures were summed, giving a grand total showing the amount of influence by each of the backgrounds on each of the figures. The over-all score was used because of the very high intercorrelations between scores of the various figures.

Authoritarianism was measured by 30 items from the *F-Scale* (1). Those from Table 7 (VII), Forms 45 and 40, were: 1, 12, 37, 41, 4, 8, 21, 23, 42, 44, 13, 19, 25, 27, 34, 39, 9, 31, 16, 26, 29, 33, 2, 6, 43, 18, 35, 38. To give us 30 items we added two from earlier revisions of the test: Item 41, from Table 4 (VII), Form 60; and Item 9, p. 238, altered to read, "Too many people are living in an unnatural, soft way; we should return to a more red-blooded, active way of life."

3. Subjects

Data were collected in two phases. The *SCI*, *F-Scale*, and Embedded Figures tests were given to a general psychology class of about 200 persons, about half of whom were men. Forty-five men were selected at random and asked to participate in further individual tests requiring two one-hour sessions. Of the 42 accepting, 40 appeared, and of these, complete data were obtained from 34.

At the first individual session, *E* was careful to establish rapport with *S*, since there is reason to suspect that response sets can bias the results of tests such as the *PCI* and *SCI* in many ways. *S* was first instructed in how to take the *PCI* test. Each of the backgrounds was exhibited singly and briefly characterized. Then each of the eight figures was shown with a fictitious name assigned to it and a brief personality description given. We wanted all *Ss* to perceive a given figure as having very roughly the same general attributes, thus controlling the variable of extremely idiosyncratic response. The descriptions were very ambiguous; for example, "This little girl is Jane Heath. She's a bit shy, but can be as active as all children are on occasion. She generally minds her mother and does what's expected of her, but is not above getting into mischief now and then." These descriptions, while slightly restrictive, gave *S* a great deal of freedom to respond within the framework furnished.

S was instructed to look at each picture as it was shown and, first, to tell very briefly what he thought was going on, then, to fill out the rating scales describing the person in that picture. Care was taken to impress on *S* that he should respond to each picture singly as it was shown to him. Later questioning indicated that all *Ss* were able to do this easily.

The first 16 pictures of the *PCI* and the complete Brightness Contrast

test were then administered. This ended the first session. The time elapsing between the first and second sessions ranged from five hours to five days, with a median of about two days. Inspection of the data indicated that this had no influence on the results. At the second session the *PCI* instructions were repeated, the remaining 16 pictures were presented, and the Rod-Frame test administered. Finally, *S* was questioned concerning his reactions during the testing. Surprisingly, none of the *Ss* remembered taking the *SCI* test in class.² Only three guessed the general idea of the experiment; the others indicated that they supposed it had something to do with perception. Further analysis of the responses to each figure strongly suggested that *E*'s instructions had had the desired effect and that *Ss* were responding to the figures with feeling and were attending to the pictured environments.

C. STATEMENT OF HYPOTHESES

The *D*-score tells us only that responses vary, and we can determine that these are consistent for individuals by the usual reliability tests. However, if we are to conclude that this is a figure-ground phenomenon, we must first demonstrate that the ground is effective in modifying the reported characteristics of the figures. Since we did not obtain responses to the figures *without ground* (and there is a question as to the possibility of a human figure's being perceived without at least an "imagined ground" being supplied by the associations of the perceiver), we adopt the device of showing that there are significant differences among the backgrounds in the manner and extent to which they modify the perception of the figures. This permits us to test our major hypotheses.

a. Hypothesis I. There will be a significant positive correlation between the tendency to modify figure as a function of ground in the perception of physical objects, as measured by the Rod-Frame, Brightness Contrast, and Embedded Figures tests, and the tendency to modify figure as a function of ground in the perception of social objects, as measured by the Picture Contextual Influence and Self Contextual Influence tests.

There are two sub-hypotheses: (*a*) The three tests of object perception will correlate significantly and positively among themselves. (*b*) The two tests of social perception will correlate significantly and positively with each other.

b. Hypothesis II. There will be a significant correlation between au-

²Because they had been given many similar tests by other experimenters over the semester.

thoritarianism as measured by the *F*-Scale, and the tendency to modify figure as a function of ground in both kinds of perception.

D. RESULTS

To show that the influence of ground constitutes a significant portion of the variance of the *PCI* test, the mean score of each figure and each background on Osgood's Factor I (evaluation; i.e., goodness-badness) was obtained from the ratings.³ These were then summed over subjects, and an analysis of variance was performed to test the relevance of age, sex, and degree of ambiguity (i.e., faces—no faces) of the figures, and the backgrounds, in influencing the evaluation scores. The main effect of background was significant ($p < .01$), indicating that variation in ground did indeed modify the characteristics attributed to the figures. Several significant interactions between the three figure variables and the backgrounds also support the hypothesis that some backgrounds influenced some figures more than others. These findings support our interpretation of the *PCI* scores as reflecting different degrees of influence of the figure by the ground.

The correlations among the six tests, all Pearson *r*'s, are presented in Table 1. Two of the three object perception tests correlate with each other beyond the .01 level; the Brightness Contrast test, however, shows no relationship to either of the others. We can thus accept Hypothesis Ia only for the Rod-Frame and Embedded Figures tests. The two tests of social perception correlate significantly with each other at the .01 level. We may thus accept Hypothesis Ib.

The major hypothesis concerning the relationship between physical object and social perception is tested by considering the correlations between the two classes of tests. All of these are significant at the .05 level or better except for the Brightness Contrast test, which did not correlate with the other physical object perception tests. We therefore conclude that Hypothesis I is confirmed.

The relationship between authoritarianism and the perceptual variables is tested by considering the correlations between the *F*-Scale and the perceptual tests. As can be seen, it correlates negatively and significantly (two-tailed test) with the *RF* and *PCI* tests, and almost so with the *SCI*. The correlation with the *EF* test is low but in the same direction as that of the

³Although these analyses were carried out on all three factors with essentially identical results as regards this particular hypothesis, the result of the one involving Factor I is most important since it takes up about half the total variance of Osgood's "dimensions of meaning." In addition, unpublished research by Osgood and his students has consistently shown these factors to have reliabilities of .6-.8 even when as few as five items are used. Factor I has the highest reliabilities.

other tests. The correlation with the *BC* test is essentially zero. Considering the entire pattern of correlations, it appears safe to conclude that authoritarianism is related to *inability* to perceive figure independently of ground. It should be noted, however, that we accept this conclusion more cautiously than the preceding ones, and recognize the necessity for cross-validation before the relationship can be regarded as established.⁴

TABLE 1
CORRELATIONS BETWEEN THE MAJOR EXPERIMENTAL VARIABLES ($N = 34$)

Test	<i>BC</i> 2	<i>RF</i> 3	<i>F</i> 4	<i>SCI</i> 5	<i>PCI</i> 6
1. Embedded Figures	.00	.55	-.20	.35	.40
2. Brightness Contrast		-.09	.05	-.05	-.18
3. Rod-Frame			-.45	.35	.41
4. F-scale				-.31	-.43
5. Self Contextual Influence					.42
P = .44; P = .34					
.01 .05					

Note—Positive correlation means that the effect of background was similar for both the physical and social perception tests. Since high scores mean freedom from background influences, the *F*-Scale correlations indicate a negative relation of authoritarianism to freedom from contextual influence; i.e., high authoritarianism is associated with high influence by ground.

E. DISCUSSION

Our results are encouragingly uniform. While a cross-validation would appear advisable, particularly regarding the relation of authoritarianism to the ability to perceive figure independently of ground, the fact that our results generally came out as predicted greatly strengthens the assumption so often made that social perception operates according to principles parallel to those of physical object perception. We now have evidence strongly suggesting that the figure-ground phenomenon operates as regards perception of persons in the same general way as in perception of physical objects. It would be interesting to see if other perceptual phenomena—such as the principle of closure, adaptation level, the levelling-sharpening phenomenon, and so on—can also be measured in the sphere of social perception. Finally, this study suggests that it may be feasible to develop tests of physical object perception as predictors of social perception and attitudes, and, ultimately, of social behavior.

⁴The reliabilities of these tests merit consideration. Because of the unusual nature of the social perception test, special techniques were used. Space does not permit an exposition of them here; suffice to note that a number of statistical tests indicated that each possessed sufficient reliability to be of experimental value. The reader seeking more detail will find it in the original thesis.

1. *Implications for Perceptual Theory*

The implications of this study are not, however, restricted to conclusions regarding the advisability of conducting certain kinds of experiments. For while the evidence we had previously cited strongly suggested that this relationship existed, the fact is that *there is no general theory of perception that would definitely have predicted it. Our prediction proceeded by analogy.* Now that the relationship has been found, it is necessary to "explain" it; and while there is no general theory of perception universally accepted, it is possible that our explanation may be of help in formulating one.

Despite theoretical differences, there are a few principles concerning physical object perception to which most contemporary theorists would subscribe. These principles constitute a kind of theory which conceives of the world as consisting of a series of events. These events may be defined in terms of energy exchanges, actions of people, or any other set of categories appropriate to the data with which the experimenter is dealing. While this lack of clearness in defining an event has disadvantages, it is consistent with our recently acquired relativistic view of the universe. Just as we cannot define such physical concepts as length or velocity in any ultimate or metaphysical sense, so we cannot define any given perception of the universe as being "more basic" or "more nearly true" than any other.

An essential concept in a theoretical analysis of our experiment is that of the association of events. We propose to treat this in terms of *conditional probabilities*. By conditional probability we refer to

$$p(A/B)$$

or the probability that *B* will occur, given that *A* has occurred. Once this conditional probability has reached some acceptable level (perhaps above .50), one tends to perceive *A* as accompanied by *B*—even though veridically, *B* has not occurred. In terms of the figure-ground phenomenon, we can say that the individual perceives the figure (*A*) in terms of qualities based on conditional probabilities related to cues from the ground (*B*). Thus, a person who samples⁵ mostly from the figure will show smaller variation due to context, while one who samples more from the ground will show larger contextual influences.

Applying this frame of reference to the *RF* test, note that our visible

⁵The notion that perceiving is a continuous process of sampling from the various stimulus sources in the environment has been elaborated in an unpublished manuscript by R. Stagner and C. M. Solley, "Perception, environmental probabilities, and homeostasis."

world—the man-made part especially—is made of vertical and horizontal lines. That is, when one sees a vertical line, one may expect to see a horizontal one, and vice versa. Further, the human body ambulates in a roughly vertical position. One may therefore perceive a “vertical” line (*A*) on the basis of probabilities derived from the visual framework (*B*) or from the somesthetic framework (*B'*). Those *Ss* who sampled mostly from the visual cues made large errors; those sampling from somesthetic cues made small errors.

Social perception is different from physical object perception largely in that joint probabilities are lower, and thus conditional probabilities (expectancies) will be at a lower confidence level. However, it will still be true that in the *SCI* situation, some *Ss* will sample more from their own inner cues, others more from the described external environment. Likewise in the *PCI* test, some *Ss* will concentrate on the figures, others on the ground. What is particularly striking, of course, is that *the same individuals* are more affected by background in the *RF*, *SCI*, *PCI* tests.

The *EF* test is somewhat parallel to the *PCI* test in that both figure and ground are visual. However, in the case of the *EF* test, the figure is also presented in isolation, since the test patterns are quite complex. These differences may account for the fact that the *EF* correlations tend to be lower than those cited above. This might be checked by using a form of the *EF* test that would not permit *S* to look at the design while searching for it in the more complex patterns hiding it.

In considering the relationships of these tests to the *F*-Scale, we note first that two recent studies (4, 10) suggest that the *F*-Scale is measuring some kind of response set of *acquiescence* rather than authoritarianism per se. The interpretation of the *F*-Scale in terms of a response set to acquiesce, to agree or submit, is consonant with our results. It may be that the *F*-Scale measures merely one more aspect of this tendency to be influenced by the field. On the other hand, we note that one of the alleged components of authoritarianism is “authoritarian submission”; and further, that the authoritarian is supposedly influenced by the “ground” of his dogmatic beliefs more readily than the non-authoritarian. Either of these interpretations is compatible with our results. The resolution of the issue awaits clarification of the meaning of a score on the *F*-Scale.

2. Implications for Personality Theory

At a more speculative level, we feel that our results have implications for personality theory as well as perceptual theory. This conclusion is based

on consideration of other investigators' research and on the logical analysis of the processes we believe to be operating in our tests. Both the *EF* and *RF* tests have been shown by Witkin *et al.* (25), Thurstone (23), and—to a lesser extent—by Pemberton (17, 18), to be related to similar personality traits. These generally include an active, independent approach to life, acceptance and competent handling of socially tabu emotional impulses, better social and emotional adjustment, and a more highly-valued self-concept. Klein's (9) results tend to collaborate these findings by discovering similar traits differentiating "levelers" and "sharpeners" (the fact that his *BC* test gave confirmatory results which did not appear in other studies may be due to the nature of his sample; viz., neurotics). Moreover, the work of Linton (12), relating some of Witkin's perceptual tests (including the *EF* test) to yielding and conformity in the Asch-Crutchfield (2, 3, 7) type conformity situation, as well as Crutchfield's finding that yielders have personalities similar to Witkin's field-dependent people and Klein's levellers, suggest that this social behavioral variable may also be related to our perceptual variables. Interpreting freely, one may conceive of the yielder as one who is influenced by the social-perceptual "ground" provided by the social group in a fashion parallel to the manner in which some persons are consistently influenced by ground in social and physical object perception.

Generalizing on these results, we suggest that the ability to perceive figure independently of ground is a very general one, occurring to different kinds of stimuli and manifested by different kinds of responses but following the same pattern. While it is, of course, true that we have no right to say that the *same* process is working in all these cases, we *are* justified in asserting that the relationships between the analogous variables in the different situations appear to be strikingly similar. Now, as Cronbach and Meehl (6) point out, whenever a number of measures repeatedly converge, or whenever a number of tests are shown to be related over broad areas of behavior, it is helpful to propose a hypothetical construct both as a shorthand means of describing what the tests measure and as an aid in formulating future research. For this ability to perceive the figure independently of the ground, we propose the construct of *ego autonomy*.

Our initial cue for the use of the concept of the ego was the amazing variety of *S-R* sequences apparently related to one another. Very few concepts in personality theory other than that of the ego have the breadth and power to deal with such diverse behavior. The ego is traditionally defined as that psychological process which reconciles the varying demands of

different parts of the behavioral environment, both internal and external. It aims at the maintenance of a stable, homeostatic condition. Suppose that there are reliable individual differences in the degree to which these ego processes are influenced by the environment; in that case, some persons will be consistently more susceptible to a wide variety of environmental pressures than will others. (The *SCI* test appears to be virtually an operational definition of this hypothesized process.) They will therefore also be less successful in coping with the environment and in maintaining a homeostatic condition, and might justifiably be described as "unstable." At least some of them might logically be expected to lean on any dogmatic authority that provides a supporting and stabilizing influence as an ego substitute to achieve homeostasis, thus explaining the relationship of our perceptual tests with the *F*-Scale.

In terms of the perceptual sampling theory used above, we might hypothesize that ego autonomy relates to a process of sampling from different stimulus inputs. Both earlier and contemporary theorists and investigators (e.g., 8, 20) have emphasized the importance of somesthetic stimulation both in the development and maintenance of the ego and feeling of "independent selfhood." Our data demonstrate that individuals differ systematically in their tendencies to sample selectively as regards figure and ground, with those concentrating on the figure sampling more from somesthetic stimuli in the *RF* test and being less influenced by ground in perceiving the self in the *SCI* test. This seems logical, since a tendency to sample predominantly from somesthetic stimuli implies that a person generally attends more to himself and stimuli originating within his own body and less to stimuli originating in the setting in which he finds himself. He will thus have a greater tendency to act independently of his environment.

We consider these findings as strengthening the view that personality is a patterned perceptual and cognitive structure.

F. SUMMARY

This study tested one aspect of the hypothesis that social and non-social stimuli are perceived similarly. Two kinds of tests of ability to perceive figure independently of ground were correlated. One used as stimuli representations of persons in several situations and descriptions of the self in different situations. Significant context effects were demonstrated in these data. The other used as stimuli the Rod-Frame test and the Gottschaldt Embedded Figures test. The context effects in the two kinds of tests correlated positively and significantly, thus supporting the hypothesis. The Cali-

ifornia F-Scale was also found to correlate with both of these context effects. People answering in the authoritarian direction are more likely to be influenced by ground in the perception of the figure than are those answering in the less authoritarian direction. The construct of *ego autonomy* is proposed as a unifying concept for theoretical interpretation of these results and those of others who have worked with similar variables.

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ANXIETY, STRESS, AND THINKING: AN EXPERIMENTAL INVESTIGATION*

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A. INTRODUCTION

This paper reports an investigation into the relationship between anxiety and thinking. It deals exclusively with that type of thinking that is said to have occurred when an individual modifies his behavior in terms of the predictive value of information. Such thinking has been called (a) reasoning, (b) intellectual functioning, (c) problem solving to accord with emphasis on (a) the information, (b) the individual, and (c) the behavior.

Prolonged periods of intense anxiety are common among psychiatric patients whose subjective feelings or overt behavior have necessitated the controlled environment of a hospital. Welch and Diethelm (5) investigated reasoning in such patients. They found that in all instances of failure to reason, intense anxiety was present. However, not all intensely anxious patients failed to reason well. Such evidence suggests the importance of relating anxiety and thinking within the framework of individual performance. Experimentation by Beier (1) indicates that levels of anxiety sufficiently intense to disrupt thinking are not unique among clinical populations. He subjected non-clinical subjects to anxiety producing stress and reported that as a group they showed a loss in flexibility of intellectual function.

The present investigation was designed to give information about changes in thinking as a function of changes in the clinically evident anxiety of hospitalized psychiatric patients. Since it was further designed to test, then to stress, and finally to retest each patient during each experimental session, repeated measurement of the same individual with the same test was necessary. This was accomplished by the use of a behavioral measure of thinking that had been shown experimentally to produce little transfer of training at low levels of tuition (4). Scores were recorded in such a manner that a trial-by-trial reproduction of each performance was possible. This allowed a treatment of results that gave maximum information about the type as well as the number of mistakes made by individual subjects.

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This report presents data which indicates the effect of anxiety on subjects considered as a group. It also presents an analysis of the stratagem, successes, and failures of a typical subject in his attempt to modify behavior on the basis of the predictive value of information.

B. SUBJECTS

Fifteen hospitalized psychiatric patients served as subjects for this investigation. All were of superior intelligence judging from their education and life achievement. None evidenced brain pathology and all were less than 50 years of age. During hospitalization, each of these patients had shown intense anxiety for periods of long duration. All subjects were tested during one of these anxious periods. They were also tested during a period when clinical observation indicated that anxiety, if present, was at a moderate level.

In order to increase objectivity, the testing and the clinical evaluations were done separately by the two authors. Neither was informed of the other's data until all patients had been evaluated and tested.

C. MATERIALS

The materials used in this experiment were selected from the Wisconsin Card Sorting Task (2). However, their use was sufficiently unique to require exposition.

Experimental materials consisted of four stimulus cards and several duplicates of 60 response cards. Each response card was imprinted with one to four identical figures: triangles (*T*), crosses (*X*), circles (*C*), or stars (*S*), in one of four colors: red (*R*), green (*G*), blue (*B*), or yellow (*Y*). The 60 response cards constituted all possible combinations of these pertinent stimulus properties with the exception of the four configurations identical to the stimulus cards.

The four stimulus cards 1RT, 2GS, 3YX, and 4BC were placed before the subject. He was instructed to sort each response card into one of four piles on the basis of similarity to one of the four stimulus cards. He was further instructed that the experimenter would tell him after each placement whether he had placed that response card "Right" (positive reinforcement) or "Wrong" (negative reinforcement), and was told to get as many "Right" as possible.

Examination of the above use of these materials reveals that the order in which the response cards are encountered influences the number of trials required to discover which stimulus property the experimenter calls

"Right." Moreover, for any one order, different sequences of response-reinforcement contingencies are not equally informative about the best strategy for discovering this pertinent stimulus variable.

An example based on Stimulus Card 1 (Figure 1) illustrates the manner in which this variable affects the amount of information given by any one

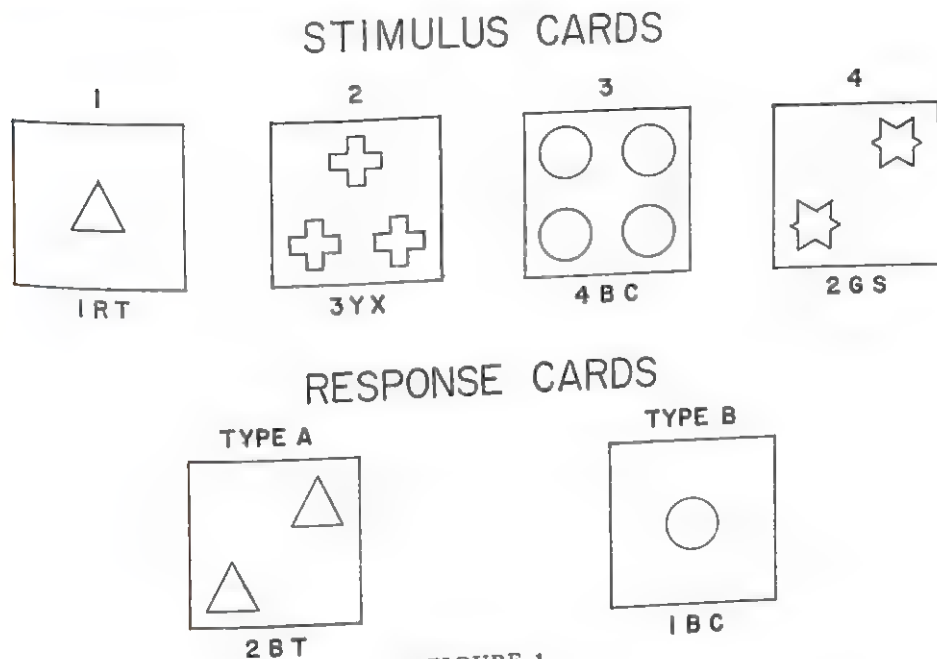


FIGURE 1

placement. If Form is the appropriate stimulus property, the placement of the response card 2BT with the stimulus card 1RT would be positively reinforced and could inform the subject that Form is the "Right" stimulus property and at the same time be a positive example of this property.¹ However, the same response card (2BT) placed with the stimulus card 2GS would be negatively reinforced and could give only the information that either Form or Color must be appropriate. In this latter placement either one or two additional responses would be required to reach the same level of certainty of information given by one "lucky" response to 1RT.

A further complication is introduced by the fact that some response cards, e.g., Type A (Figure 1) bear configurations that can be matched for simi-

¹See Bruner et al. (3, pp. 62-63) for a discussion of the need to differentiate between positive and negative examples in problems involving categorization.

larity with any one of three stimulus cards (Stimulus Card 1 for Form, 4 for Number, 3 for Color). Other response cards, e.g., Type *B* (Figure 1) can be matched appropriately with only two stimulus cards with one placement similar to two stimulus properties, e.g., (Stimulus Card 3 matches for both Color and Form).

These variables, important² for even one placement, become critical for sequences of placements. If performance measures are to reflect the ability of the subjects rather than chance variability, prearrangement of the order of presentation of response cards is mandatory. In the present experiment prearrangement was based on an analysis of the exact nature and amount of information given by all possible sequences of response-reinforcement contingencies for all sequences of any two response cards.² Thus in any sequence of two trials, the subject could perform the operations which could produce certainty of information.

D. PROCEDURE

1. *Directions*

The patient was seated at a small table in an experimental room that remained constant in arrangement of furniture, illumination, and noise level at all times. The experimenter was seated to the right rear of the patient out of his line of vision. The experimenter limited his verbalization to standardly worded remarks. These ranged from test instructions to short statements urging the subject to continue working.

Prior to the experiment, each subject was given two short tasks. These enabled the experimenter to ascertain if the subject would readily differentiate among the exact colors, numbers, and forms that became pertinent stimulus variables during the experiment. These tasks also allowed the experimenter to determine whether or not the subject would interpret the key word "*similarity*" in a manner appropriate to the assumptions of the experiment.

The experiment began by the experimenter placing the four stimulus cards before the patient and alerting him to the possibility of concept attainment by saying:

Here are four cards with designs on them. I am going to put four blank cards just below them. Now, I am going to hand you cards that are similar to these cards on top. When I give you a card, you are to

²This analysis is lengthy and in the interest of brevity was omitted from this paper. It is available in mimeographed form along with a list of prearrangement used in this experiment by writing the authors.

look at it and decide—*on the basis of similarity*—which of these top cards it belongs with. When you have decided, put the card you hold—face up—on the blank card under the one you choose. Each time you lay a card down I will tell you whether it is "Right" or "Wrong." If I say "Wrong" don't change it, but go on to get the next one "Right." The point—*of course*—is to get as many "Right" as you can. Now let me go through the instructions again.

After repeating these instructions, the patient was asked if he understood what he was to do. Any questions were answered by verbatim repetition of the pertinent phrases from the instructions.

2. *Examination for Discovery*

The experimenter handed the response cards to the subject face down, one at a time. The first group of response cards from which the experimenter drew were all Type *A* cards, therefore each placement corresponded to one, and only one, pertinent stimulus property. The first stimulus category to be called "Right" was determined in the following manner. After the subject had placed the first response card, the experimenter determined the stimulus basis for that response and called the response "Wrong." The same procedure was repeated for all responses until the subject made at least one placement which utilized all three pertinent stimulus categories. In other words, the first response called "Right" was the first response to the last pertinent stimulus category utilized by the subject.

This procedure allowed the experimenter to determine the relative difficulty, for each subject, of discovering each of the three pertinent stimulus properties. It also assured that this discovery had been made before the subject was required to utilize these categories in the presence of Type *B* cards.

3. *Test (pre-stress) for Utilization*

At this point, the experimenter began to draw from a pack of response cards that were arranged Type *A*, Type *B*, Type *B*, Type *A*, and further arranged to allow the necessary placements for certainty of information to be completed in two consecutive trials.

When the subject succeeded in sorting five successive cards according to the first stimulus category called "Right," the experimenter changed the basis for reinforcement to the second property discovered by the subject during the Type *A* series. The only cue to the shift came from reinforcement. After the subject had sorted five consecutive cards according to this second stimulus category, the third category was called "Right." If, in

60 trials, the subject was unable to discover or shift among all three pertinent stimulus properties, this procedure was terminated.

The procedures for determining the discovery of stimulus variables and that for determining their utilization are collectively referred to as the Test (pre-stress) in this paper.

4. *Stress Period*

When the subject had completed the Test (pre-stress), he continued to perform 30 trials in which reinforcement was determined, not by his placements, but was set in such a manner that one out of six responses was called "Right." The subject was not informed that the task had become systematically unsolvable. This part of the experimental procedure is referred to in this paper as the Stress Period.³

5. *Retest (post-stress) for Utilization*

After the Stress Period, the procedure described as the Test was repeated. This part of the experimental procedure is referred to as the Retest (post-stress).

E. RESULTS AND DISCUSSION

It was the intention of the experimenters to obtain quantitative measures that could be analyzed with meaningful counting techniques without obscuring the uniqueness of individual performance. In other words, we were as interested in the types of mistakes as we were in their number; as interested in how subjects attempted to solve the problem as in how well they succeeded. In keeping with this dual interest, results are presented in two sections.

The first section deals with all 15 patients as a group. It presents a gross measure of success or failure in modifying behavior on the basis of the predictive value of information, and depicts the influence of anxiety on such a performance.

The second section presents a detailed performance record for one individual (Subject 13, Table 1). The performance selected for presentation may be called typical of the group in the sense that it is modal in more performance measures than is any other individual record.

³No endeavor is made in this paper to elaborate the concept of "cognitive stress" except to describe the operations said to produce such stress. The reader is referred to Bruner et al. (3, pp. 16-17) for a theoretical approach that appears to link these operations with the performance they produce in the present experiment.

1. *Group Results*

Table 1 shows the total number of trials required by each of 15 subjects to discover, utilize, and shift among the three pertinent stimulus variables: Color, Number, Form. The table presents this measure of performance for each of two experimental conditions: Test (pre-stress), Retest (post-stress), at two levels of clinically evident anxiety: moderate anxiety, intense anxiety.

TABLE 1
NUMBER OF TRIALS REQUIRED TO DISCOVER AND SHIFT AMONG PERTINENT STIMULUS
VARIABLES FOR TWO EXPERIMENTAL CONDITIONS (PRE-STRESS, POST-STRESS) AT
MODERATE AND INTENSE LEVELS OF CLINICAL ANXIETY

Subject No.	Moderate anxiety		Intense anxiety	
	Test (Pre-stress)	Retest (Post-stress)	Test (Pre-stress)	Retest (Post-stress)
1	32	27	31	34
2	54	*60(2)	*60(2)	*60(0)
3	21	25	54	*60(2)
4	24	23	49	*60(1)
5	19	20	35	38
6	34	*60(1)	*60(1)	*60(0)
7	42	50	44	*60(0)
8	36	43	38	*60(0)
9	34	*60(1)	*60(1)	*60(0)
10	25	27	*60(2)	*60(0)
11	34	30	*60(2)	*60(0)
12	35	*60(2)	*60(0)	*60(0)
13	22	40	25	*60(0)
14	22	20	20	26
15	35	*60(2)	*60(2)	*60(0)
% Reaching criterion in 60 trials	100%	67%	53%	20%

Some patients, at some levels of anxiety, were unable to respond in terms of all three pertinent stimulus variables in 60 trials. Such performances are tabulated as *60 (number of variables utilized). For example, the score *60(2) means that in 60 trials the subject matched five successively correct for only two of the three pertinent stimulus variables.

The final row of Table 1 lists, for each column, the per cent of subjects who discovered, utilized, and shifted among all three pertinent stimulus variables in 60 trials.

2. *Performance of a Typical Individual*

The computation of individual performance records was facilitated by two types of analysis of data. Each trial was analyzed to determine the

stimulus category which served as the basis for that placement.⁴ Each sequence of two placements was analyzed to determine what use the individual had made of the information given by combining the first response with its consequent reinforcement.

Figure 2 presents in graphic form a measure derived from the second type of analysis. It shows the performance of a typical subject during a period of moderate anxiety and intense anxiety, for the two experimental conditions: pre-stress and post-stress.

These curves have been named Efficiency Curves and require elaboration. It can be seen that the most efficient strategy for solution consists of shifting the basis of response when negatively reinforced and staying when reinforcement is positive. One other criterion of efficiency must be added. The strategy of "shifts" and "stays" must result in rapid discovery and continued utilization of the stimulus category called "Right" by the experimenter. A representative performance curve should reflect simultaneously both of the above criteria. This was accomplished by plotting curves in which: (a) a positive reinforcement followed by a "stay" elevated the curve, (b) a negative reinforcement followed by a "stay" depressed the curve, (c) both a negative reinforcement followed by a "shift" and a positive reinforcement followed by a "shift" produced a lateral extension of the curve. Such a curve combines the classic error plot, in which each error depresses and each success elevates the curve, with a curve representing the appropriateness of each "shift" or "stay" to the reinforcement of the preceding trial.

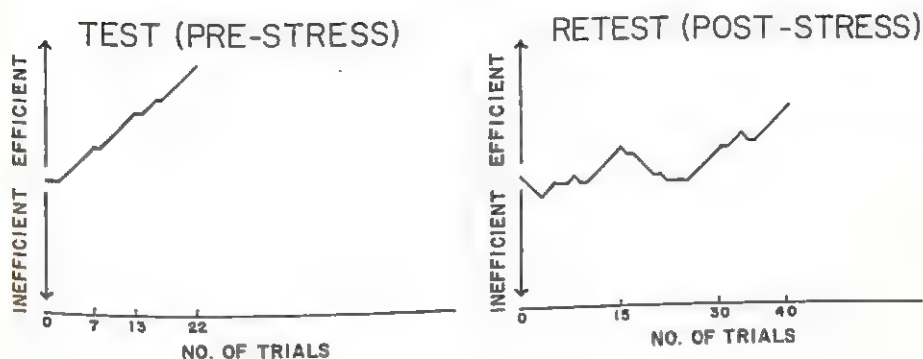
The above Efficiency Curves indicate that, in the presence of both intense anxiety and experimental stress, the performance of the typical subject was less efficient in both the number of trials required to reach a given level of performance and in the strategy employed to encounter substantiating response-reinforcement contingencies. Inspection of such curves can reveal information about the sequential patterning of strategy. For example, a rise in the curve for five consecutive trials followed by a four-trial decline will occur only when the subject continued to respond on the basis of the previously reinforced stimulus category for four trials after the experimenter had shifted the basis for calling "Right" or "Wrong."

Additional information about the sequential patterning of strategy can be gained from a trial-by-trial analysis of the relationship among the stimulus basis of response, reinforcement, and subsequent 'shift' or 'stay'. Such

⁴The criteria for determination was substantially the same as that reported by Grant (4).

an analysis, over a number of trials, can reveal the specific use, non-use, or misuse which a subject made of the predictive value of information.

MODERATE ANXIETY



INTENSE ANXIETY

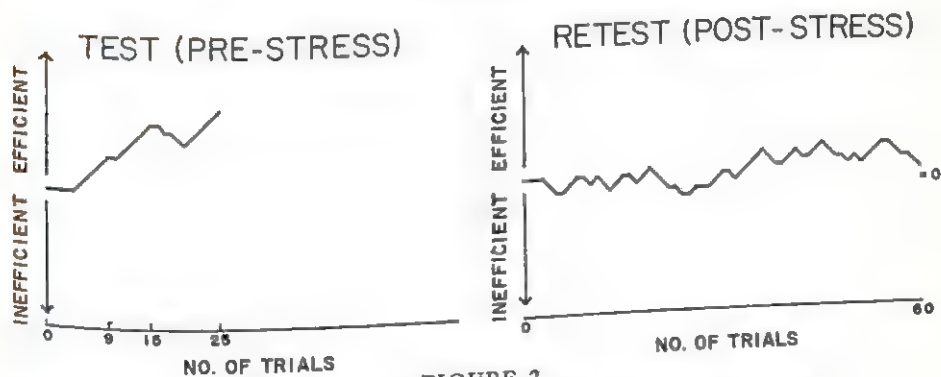


FIGURE 2
EFFICIENCY CURVES FOR PERFORMANCE OF A TYPICAL SUBJECT

There is, at any one placement, only one sequence of future placements that will result in the most rapid criterion performance. However, there are several patterns of deviation from this one efficient sequence. Many of these patterns can be analyzed to discover the principle or strategy on which they are based. For example, the typical subject after stress during intense anxiety made 32 consecutive placements in which all Type *B* response cards

were matched with the stimulus card bearing the greatest number of similar stimulus properties. Such a performance is inefficient because the performer failed to utilize the information given by verbal reinforcement in selecting the stimulus basis for matching. It must be noted, however, that this same sequence of placements shows accurate, but non-informative use of all three visual stimulus variables. Therefore it can be said that this particular subject, during this particular series of placements, utilized a strategy based exclusively on visual stimulus properties. The performance was not randomly inefficient. It was inefficient in a particular way because of a particular modification of behavior based on the predictive value of only part of the available information.

It can be seen that the above type of analysis leads to a description of differentiated patterns of misuse or non-use of differentiated sources of information. Such a description is based on a general statement of the strategy underlying a series of inefficient placements. When this analysis was applied to the performances of the 15 subjects in this experiment, it was found that most sequences of inefficient placements did reveal a specific pattern that was related to a specific strategy based on the misuse or non-use of specific sources of information.

While it is beyond the scope of the present paper to enumerate all of these strategies, it does seem appropriate to describe the method by which they were differentiated, and to suggest the possibility of making meaningful statements about a subject's "thinking difficulties" on the basis of a knowledge of the "kinds of inefficient strategies" he applied to the task of this experiment. Strategies were differentiated in the following manner:

1. Each of a series of inefficient placements was reproduced in order to determine the sequential relationships among the stimulus basis of response, reinforcement, and subsequent 'shift' or 'stay'.
2. On the basis of these relationships, a unifying strategy was stated (e.g., match for the greatest number of stimulus properties) the extension of which would produce, when applied to the experimental task, the exact placements of No. 1 above.
3. The strategy was analyzed to determine what use, misuse, or non-use of available information it implied.
4. Terms were found in psychological and psychiatric parlance which implied the same use, misuse, or non-use of information. Examples of such terms are: rigidity, confusion, perseveration, faulty memory, narrowing of perceptual field, negativism, etc.

By charting the points at which, and the manner in which, shifts in strategy caused performance to depart from and reapproach efficiency, information is gained about the effect of experimental conditions by describing the manner in which they affect the modification of behavior on the basis of the predictive value of information. Because the strategies behind such deviations from efficiency can be linked to specific use, misuse, or non-use of information, statements about the thinking of individuals can be phrased in terms of those psychological concepts that imply similar deviations from efficient thinking. Such statements can be compared with other evidences of thinking disorder, both experimental and clinical, to determine if they are applicable as a description of the individual's pathologic thinking reaction to his general environment.

F. SUMMARY AND CONCLUSIONS

1. Thinking was defined as a process that is said to have occurred when an individual modifies his behavior on the basis of the predictive value of information.

2. Such modification of behavior was investigated by means of a card sorting task.

3. Fifteen psychiatric patients were examined with the task at both an intense and a moderate level of clinically evident anxiety. During each experimental session each patient was subjected to a period of stress and then re-examined with the task.

4. Results indicate that as a group more trials were required to modify behavior in accordance with predetermined criteria of success when these patients were intensely anxious than when they were moderately anxious. Experimentally induced stress affected performance in the same manner.

5. A method of analyzing performance is suggested whereby it is possible to differentiate among the types of thinking difficulties produced by experimental conditions. Such information should prove helpful in delineating the subject's pathologic thinking reaction to his general environment.

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THE DYNAMICS OF HYPNOTICALLY INDUCED ANTI-SOCIAL BEHAVIOR*

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A. INTRODUCTION

The question of whether or not anti-social behavior can be induced hypnotically has, until recently, remained an issue in experimental hypnosis upon which the evidence and opinion has been strongly divided. The nature of this division has been contaminated by experimental procedure, the motivations of the experimenters, and the variations in "settings" under which the experiments have taken place.

Nevertheless, it appears rather definitive that under certain conditions it is possible to hypnotically induce behavior which in reference to the subject's own values can be called anti-social.

Weitzenhoffer (1), in reviewing the major literature in this area of investigation, sums the issue up as follows: . . . "that (a) it is unlikely that one can compel a hypnotized individual to commit anti-social acts by virtue of any inherent compulsive power the suggestion may possess per se; but that (b) it appears entirely feasible to do this by distorting the subject's awareness in various ways." Thus it is not difficult to induce anti-social behavior in a subject when his altered perception of reality does not allow for an awareness or identification of "anti-social" with the act he is actually performing.

On the other hand, it appears to be quite difficult to produce anti-social behavior hypnotically with the subject's awareness of the true nature of the act.

There are a number of reasons why this problem has received such very considerable attention in experimental hypnosis. In part, it relates to the defensive and protective attitude that many scientific workers have been compelled to develop in working with this modality. In literature, religion, and folklore hypnosis has historically been identified in part with evil, the devil, and a genuine "Svengali" concept.

In order to purify it, those who have wished to use it beneficially culti-

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vated the concept that "a subject will not do anything in hypnosis that is against his will" or "that he would not do in a waking state."

Close examination of these traditional postulates reveal that they are rather vacuous statements. For one, we have no valid indicator of will, let alone more sophisticated measures of values or standards that we can use adequately to support such a statement. We have experiential parameters that are determined by needs, defenses, and other motivational elements. We cannot say, however, at what point additional motivation will permit a subject to give up his standards or to find his defenses inadequate in the face of new and intense drives stemming from recently acquired sources of motivation.

The real issue, and perhaps one that far transcends the problem of anti-social behavior is: when a subject *does*, with apparent awareness and recollection, commit an anti-social act as a result of hypnotic intervention—why does he do it?

Weitzenhoffer (1), summarizes the explanations that characterize virtually all studies to date: subjects believe (a) that there were protective measures taken (the traditional explanation "they knew it was only an experiment"), (b) subjects trusted the hypnotist, (c) subjects had confidence that there were legitimate reasons for the hypnotist's requests, or (d) the subjects had latent needs or criminal tendencies.

In some instances there is no doubt that cases can be found to confirm all of the above possible explanations. Yet, if we omit the last (latent criminality) all explanations revert to essentially one: the subject's appraisal and understanding of the *experimenter's* motives.

With the expanding concept of non-verbal communication and especially with our observations of the nature of communication between patient and therapist in hypnotherapy, we know that many individuals in hypnosis are capable of a penetrating and exacting awareness of ideas, motives, feelings, and needs on the part of the hypnotist. They may become aware of these consciously and incorporate them into the externalized relationship with the hypnotist, or they may retain them on a subliminal basis and incorporate them into their intrapersonal defensive system in the same way that they do other non-conscious material and impressions.

It is not unlikely then, that hypnotic subjects have for the greater part a valid insight into the motives and attitudes of the experimenter who is attempting to induce in them anti-social behavior. Their reactions, therefore, must frequently reflect their attitudes and coincide with the above summarized explanations since they are, for the greater part, true.

The one non-specific variable that has contaminated much work in experi-

mental hypnosis has been the experimenter-subject relationship, and the range and level of communication within that relationship. Suggestion per se is not a controlled variable since for the subject suggestions form part of a contextual configuration which includes the hypnotist as he perceives him. The essential activating mechanism in hypnotic interaction is the subject's newly arrived at reality orientation which is primarily determined by his awareness of what he "sees" in the hypnotist and how he "reacts" to this.

Different subjects with different personality characteristics will perceive rather sharply different hypnotists (in the same individual) and will therefore establish different levels of hypnotic functioning in keeping with these perceptions.

The basic issue of hypnotically induced anti-social behavior cannot be understood except in relation to the hypnotist's feelings and what he communicates to the subject about himself in relation to this goal which he and the subject are striving for.

In a theoretical framework the significance of our interest in anti-social behavior transcends this limited focus to include the fundamental question: Can we, through hypnotic techniques, obliterate an individual's resistances and defenses in any area of his behavior functioning and bring about new motivations and reactions in keeping with our (hypnotist-therapist) objectives?

Obviously this relates to the basic problem in psychotherapy: the reduction of disruptive motives and responses and the development of more adaptive drives and reactions. Although the goal is socially acceptable in psychotherapy rather than anti-social, as in experimental hypnosis, the issue is the same. Can we go beyond certain limitations in responsiveness, and if so, how? This question is the same as that continually faced in psychotherapeutic recovery, gain, and improvement. We see such progress fairly often, but the reasons for it still remain clouded in secularized jargon of the therapeutic schools. While many of the explanations are "meaningful" in a phenomenological sense, they are far from the more basic elements of behavioral organization that we seek as a unified explanation.

The experimental data to be reported upon now does not purport to answer any of the questions raised above. It is presented in the expectation that further investigation along the lines described may in time bring us closer to the studying of the basic mechanisms which are involved in the reactions we refer to as hypnotically induced behavior. For these mechanisms are not restricted to anti-social behavior, though they may be more accessible to study in this form.

B. CASE MATERIAL

An attempt was made to describe the conditions under which anti-social behavior could and could not be induced in one hypnotic subject. This study was conducted over a period of several months, and a great deal of collateral data obtained on the whole range of hypnotically induced behavior in this one particular subject. Ultimately, it is intended to publish a report which will deal exhaustively with the meaning of hypnosis to one individual and the variations in its functions over a period of several years as well as the evaluations relating to these variations.

What is reported now is a brief section of the protocols dealing with anti-social behavior when it was first studied in this particular subject.

The subject was a 28-year-old married male college student who volunteered as a subject for experimental studies in hypnosis. He was capable of somnambulism and in a classical sense could effect all of the actions characteristic of this level of hypnosis.

In the course of earlier history taking and through the use of questionnaires, projective techniques, and other psychological tests, some descriptive understanding of this individual's values, social concepts, and mores were arrived at. The anti-social behavior selected was of a nature that the subject strongly objected to doing when asked if he would in the waking state. The act itself will not be described here for reasons of legality and recognizability. Needless to say, it was not only anti-social but punishable by law.

Suggestions for the hypnotically directed act were printed on a card which was, in all phases of the study, read to the subject. The study itself took place within a one-way vision room and was at all times observed and heard by multiple professional witnesses.¹

1. *Experiment 1*

In a somnambulistic hypnosis (all hypnotic phases to be described in this report were carried out at this level of hypnosis), the printed directions requesting the anti-social act were read to the subject. He appeared to be undisturbed by them and made no effort to act upon them. When read over and over again he would at times arise from his chair and walk around for a few moments and then return to his chair saying, "I cannot do it." Four experimenters participated in this study and each one read the directions in as like manner as possible and alone with the subject at different times and

¹Four experimenters were involved in this investigation, each one working with the subject independently and on different occasions, with the same experimental procedure.

always with at least one day apart. All experimenters induced the hypnotic state themselves and all had been selected because of their ability to produce *apparently* equivalent states of somnambulism in this same subject. All experimenters failed to obtain anti-social behavior in this stage of the study.

2. *Experiment 2 (Perceptual Alteration)*

In this phase of the study the directions were changed so as to have the subject hallucinate a totally different and socially accepted act while beneath this he was directed to perform the original anti-social act.

Results: With three of the four experimenters the subject performed the "anti-social" act at once, with no remorse or apparent resistance. With the fourth (the only female experimenter) he acted almost exactly as he had in Experiment 1 and insisted that he could not do what was requested of him.

This experimenter revealed later that she herself was somewhat upset by the nature of the requested act and by the deception. She accepted the legitimacy of the experiment and procedure but still reacted with strong feelings. This "emotion" was not apparent superficially upon observation.

3. *Experiment 3*

In this stage of the study the procedure reverted back to Experiment 1 where the direct suggestions were again given. At this time they were followed by the experimenters saying "It is all right to do this, you can do it, I would like you to do it, go on—try, that's fine, you're starting to do it, there you go, there you go, that's very good now, it's perfectly all right."

Results: Only one of the experimenters could obtain positive results this way. He was able to do this consistently.

4. *Experiment 4*

Whereas, in all other phases of the study, each experimenter had started from the waking state and established a hypnotic relationship him(her)self, in this experiment, the one experimenter who could obtain the anti-social behavior induced the hypnosis and transferred the relationship in turn, on different days to each of the other experimenters.

Results: Using the same printed cards and the same directions as in Experiment 3, two of the three remaining experimenters could obtain positive results.²

²At this point in the experiment the female experimenter asked if she could be relieved of her share of the responsibility since she found it too disturbing. This request was granted and the study continued with three male experimenters.

5. *Experiment 5*

At this point the original direct suggestions were again administered as in Experiment 1. Again negative results were obtained by all of the experimenters.

6. *Experiment 6*

The one experimenter who had first obtained the initial positive result now utilized the direct suggestion technique of Experiment 1 with one additional technique: he had the subject visualize himself performing the anti-social act, with the experimenter present (in the visualization) just prior to actually requesting the act.

Results: The subject consistently produced positive reactions involving anti-social behavior. The other two experimenters could also obtain positive results with this technique.

Further attempts several weeks later at Experiment 1 and at waking urging to perform the anti-social act met with failure on the part of all experimenters.

The experimenters: All of the experimenters were academically known to the subject and he had in each case willingly worked with them. The one experimenter who had obtained the initial positive result was the one who had first established the hypnotic relationship with the subject and who had worked at various hypnotic levels with the subject for a period of some eight months.

C. SUMMARY

This paper has reported upon a number of observations of one hypnotic subject and his ability and inability to perform an hypnotically induced form of anti-social behavior.

It is strongly suggested by the results that the obtaining of the experimental goal was primarily dependent upon the hypnotist and the extent to which he could enter into and participate in the act himself. The subject is not involved alone, but is part of a newly created structure and reality reference in the hypnotic relationship. Subliminal perception of the hypnotist's ideation, affect, and projective behavior undoubtedly played a major rôle in creating the "conditions" which eventuated in the subject's altering his behavior in the manner that he did and performing a task for which he had initially strong resistance and adequate defenses.

In relating this observation to psychotherapeutic procedure, it seems likely that if we are going to be able to intervene on a direct or hypnotic level into a patient's deep-rooted and value-fixed obsessions, compulsions, fears, etc.,

we as therapists are going to have to learn how to participate more actively within the hypnotic relationship.

Though verbal suggestion in hypnosis has distinct limitations as a motivating device, this does not imply a similar limitation of hypnosis itself as a therapeutic procedure and treatment relationship. It would seem that the hypnotic relationship is perhaps uniquely structured for non-verbal communication, and the alteration of perceptual orientation on the part of the patient in psychotherapy may at times require hypnotic intervention on this level if strongly reenforced defenses are to be made more plastic and newly acquired drives motivated to survive.

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COLOR-CODED MULTIPLE-IMAGE PHOTOGRAPHY FOR STUDYING RELATED RATES OF MOVEMENT*

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For studying certain human movements as patterns of response we have found that useful information can be obtained by recording both the stimulus and the response by multiple-image photography and coding the pattern with color. The method provides an exact record of the latency, direction, and rate of movement for each trajectory within the pattern. The records, made on 35 mm. Ektachrome or Anscochrome film, are easy to file, easy to interpret, and once the apparatus has been set up, easy to obtain.

For a stimulus pattern we use the movement of a board within the field,

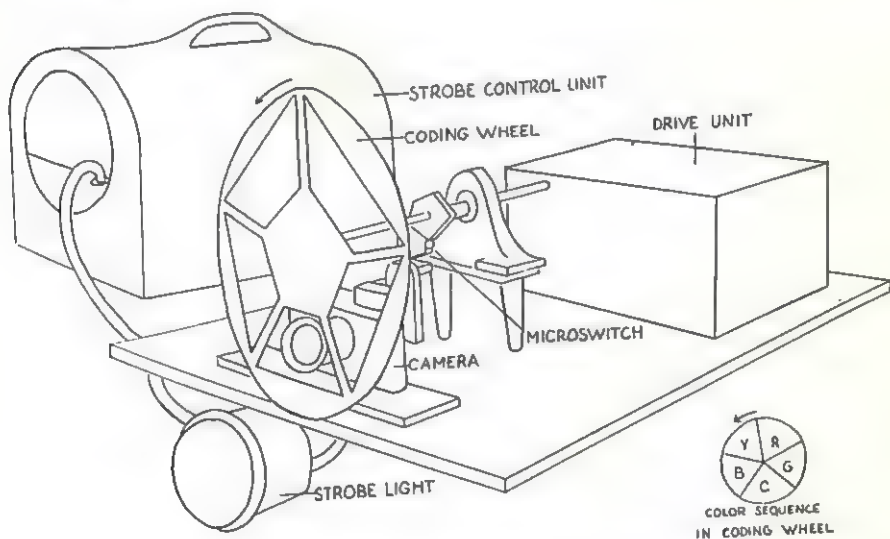


FIGURE 1

APPARATUS FOR COLOR-CODING STROBOSCOPIC MULTIPLE-IMAGE PHOTOGRAPHS

An aluminum wheel rotates in front of the camera. The apertures are covered by gelatine filters, red, yellow, blue, chocolate, and green. As each successive aperture comes into place a microswitch is actuated and a synchronous flash emitted by the Strobe unit.

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the beginning of the movement serving as a signal to the subject. Scotchlite reflecting tape marks both the signal board and the subject. To take a picture the shutter of the camera is left open and the action is recorded by a strobe unit flashing at rates of 5, 10, or 20 fps. An aluminum wheel with five apertures, each covered with a gelatine filter of a different color, rotates in front of the camera in synchrony with the flashes (Figure 1). In this way all phases of the action are recorded as a single time-space pattern in which the direction of movement and the time relations between the trajectories are indicated by the sequence of colors. Since the sequence is repeated after $\frac{1}{4}$, $\frac{1}{2}$, or 1 second according to the flash rate, an upper as well as a lower limit is placed on the time within which latency can be determined. The upper limit can be increased by enlarging the wheel and adding to the number of colors; the lower limit by increasing the flash rate. For the movements which we have studied, however, these limits have been adequate.

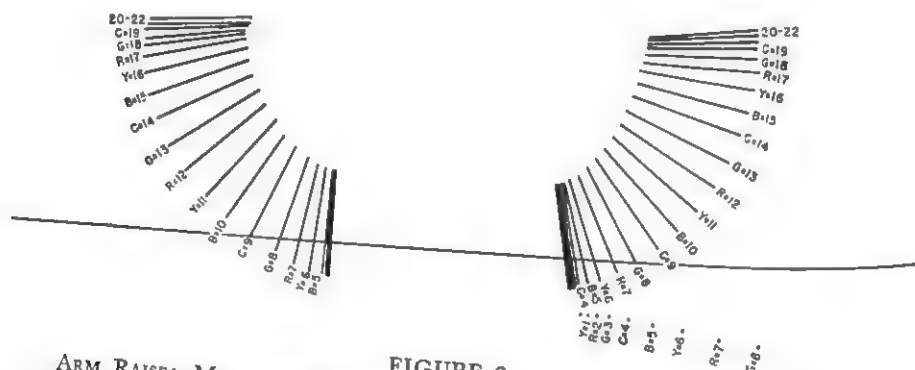


FIGURE 2

ARM RAISE: MOVEMENT PATTERN TRACED FROM COLOR-CODED PHOTOGRAPH
At signal S raises both arms, which have been marked with reflecting tapes. Images are recorded at a rate of 20 per second. Reaction times are determined by reference to stimulus pattern in lower right. Sequence of colors as shown in Figure 1.

An example of the method is shown by the line drawing in Figure 2, which has been traced from a photograph. A measure was sought of the difference in the pattern of movement between the right and left arms. The subject wore a black jacket of non-reflecting cotton. A stick marker covered with Scotchlite reflecting tape (#3270, Silver) was fastened by elastic bands to each arm (1). A thin board, also marked with Scotchlite, was held by the experimenter so that its flat surface just touched the back of the subject's right hand. The removal of the board was the signal to the subject to raise both arms to the horizontal. The movements of the two

arms and the board were recorded on color film by a General Radio Strobolume flashing at 20 fps in front of the open shutter of a Robot Star camera. The movement of the board, which provides the time record, appears in the lower right of the picture as a series of colored dots. The first, T-0, is white; T-1 is yellow, T-2 red, T-3 green, T-4 chocolate, T-5 blue, T-6 yellow, etc. If the colors in the arm patterns are compared with those in the time record it can be seen that there is a latency of $3/20$ of a second for the right arm and $4/20$ for the left. By comparing the colors in

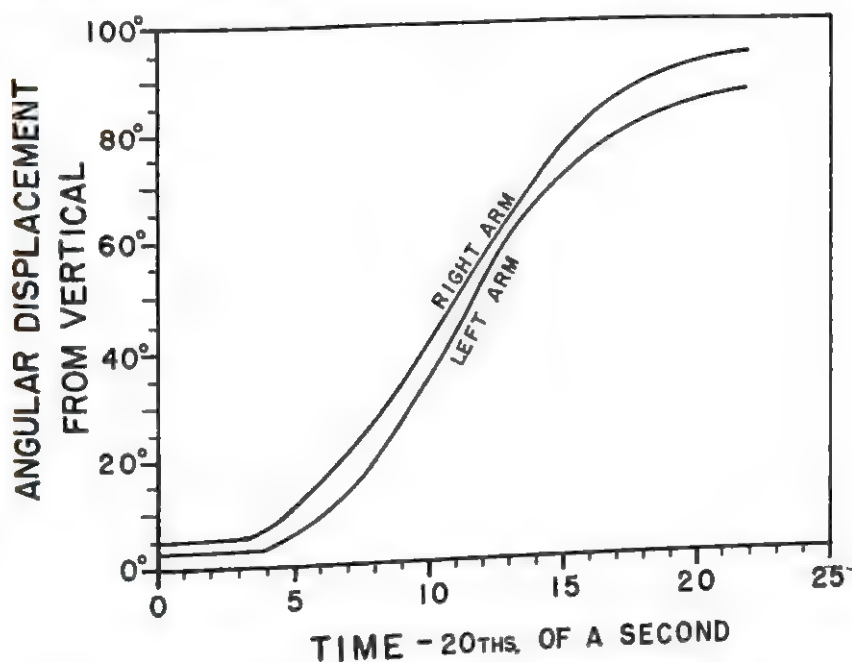


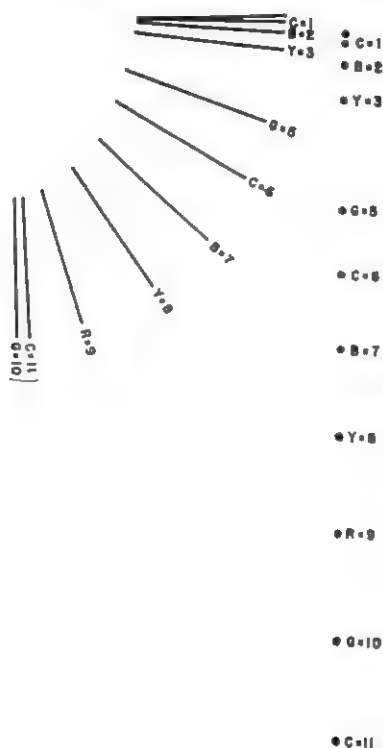
FIGURE 3

ARM RAISE: GRAPHICAL COMPARISON OF MOVEMENTS OF RIGHT AND LEFT ARMS

the two arm patterns with each other it can also be seen that the initial difference between the two arms increases, then decreases, and finally increases again during the movement. These differences are shown graphically in Figure 3.

In Figure 4, the movement under study is arm drop. S's right arm was supported at horizontal level by the marked board held by E. S was instructed to allow his arm to fall when the board was dropped. The movement was completed in $1/2$ second, though there was some rebound at the end. In a black-and-white picture, rebound produces a confusion of images.

In color, however, such a pattern can be easily interpreted. For taking this picture, the wheel was reversed, so that the color sequence is the opposite of that in Figures 1 and 2. A gap in the sequence of colors between yellow and green indicates that the Strobolume has missed a flash.



FLOOR

FIGURE 4

ARM DROP: MOVEMENT PATTERN TRACED FROM COLOR-CODED PHOTOGRAPH
S rests arm on board held at shoulder level and allows it to fall when board is released. Flash rate 20 fps. Sequence of colors the reverse of sequence in Figure 1. Fourth flash is missing.

Displacement curves for board drop and arm drop are shown in Figure 5.

From our experience, we believe that the method, because of its accuracy and convenience, might have a wide application for the analysis of movement.

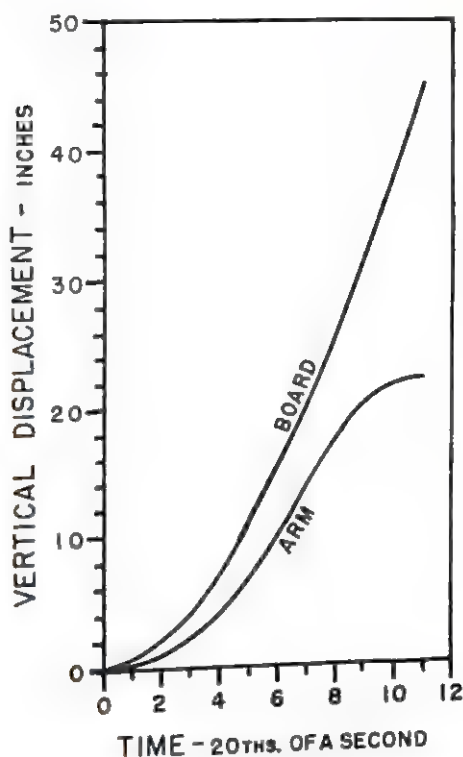


FIGURE 5
ARM DROP: VERTICAL DISPLACEMENT OF ARM AND BOARD COMPARED

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A PERCEPTUAL CHANGE OCCURRING DURING PSYCHOTHERAPY: THREE CLINICAL HISTORIES*

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A. INTRODUCTION

This paper reports three case histories of persons undergoing psychotherapy in which a peculiar perceptual phenomenon has occurred. These cases have been observed by the writer and others while counseling college students of disparate socioeconomic levels in widely separated geographical settings. It is hoped that this report will help in throwing light on the definite but elusive and complicated relationship between perception and personality.

B. CASE 1

A 20-year-old male junior complained of difficulty in making and keeping friends, poor sexual adjustment with compulsive masturbation, insomnia, and vague feelings of free-floating anxiety. Although in the 98th percentile rank of the *ACE* he was doing only passing work. The client-centered counseling consisted of about 14 interviews (one per week) and was conducted by a male counselor of about three years' experience. The major dynamics of the case involved severe castration feelings (in the broadest sense of inadequacy in assuming the social rôle of the man) due mainly to an overprotective father and secondarily to an unresolved Oedipus complex in the classical pattern. During the tenth counseling session, the client had discussed his relations with his parents, particularly his mother, and had achieved a good deal of insight. He had become quite emotional, but had apparently calmed down by the end of the hour. At his next interview he reported the following experience (as based on verbatim notes):

When I left last time, I had the strangest experience. I felt sort of tired and wrung out, but relieved too. As soon as I opened the door, I saw that everything outside [the counselor's office] looked different. Forms were sharper; I could see the edges of things more clearly. Col-

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ors were much more vivid, they just leaped right out. Oddest of all, I seemed to have a very improved depth perception. I saw things as three-dimensional, where before they'd seemed flat. As I walked down the street to the fraternity house, everything looked new and clear, clean and freshly made, as though the world had been reborn. It seemed also "objective"—it was unconnected with me. It was as though for the first time I saw things as they really are, not full of my own emotions and associations to them. I realized, I guess for the first time, that things could stand in their own right, that they weren't necessarily related to me. I saw a child with its mother and repeated silently to myself with a good deal of pleasure the word "child"; I thought, "Child—that's a child." It delighted me that the child could be a child without my doing anything about it. I felt like the first man naming the things in the newly created world around him. The feeling lasted in all about an hour, then gradually died away. Getting back to the house and having to talk to the fellows seemed to help dispel it, but it was weak by then anyhow. Now I don't feel quite as good and things don't look as new and fresh, and I don't know whether it's because the feeling left or I've just got used to it.

There are several interesting points in this narrative. First, the experience was apparently entirely visual and definitely realistic and concrete as opposed to autistic and abstract in nature. Second, it had a predominantly pleasant feeling tone, although a couple of weeks later the client admitted that the novelty of it had been rather frightening. Third, it was temporary, despite the fact that he had enjoyed it and made a conscious effort to "keep" that frame of mind. Fourth, and of possible interest to students of language, is the fact that a verbal label was "separated" from the visual image, redefined, and then reapplied in a seemingly more realistic fashion. Finally it is of interest to note the relationship between the client's dynamics and the experience—i. e., noticing a child and its mother as more clearly perceived after redefining his own child-like perception of his mother, and referring to himself as "the first man," possibly indicating a decrement in castration feelings.

C. CASE 2

An 18-year-old sophomore boy complained of extreme feelings of social inadequacy and bashfulness—especially in heterosexual relations—and difficulty in concentrating on his studies. Counseling was largely supportive but included non-directive and interpretive sessions when they seemed appropriate. The counselor was a male psychological intern judged to be of about average competence and of the "eclectic" approach. Counseling lasted about eight months. After the first few interviews, it became apparent that the major problem was a pretty simple reaction to a very authoritarian father who

was as cold and rejecting as he was domineering. The aim of counseling as worked out by the client and counselor together was to help the client achieve self-confidence by realizing his own potentialities. This process was to be aided by interpretive sessions and examining his actions and feelings. The client gained insight fairly quickly, stating that he had always felt vaguely that his problems lay in a feeling of insecurity and dependence which in turn were due to fear of his father. This seed of insight had remained merely potential, however, because his father's rejecting attitude generated strong guilt feelings; i.e., "If he doesn't love me it must be because I've done something bad." Occasionally, however, he was able to enjoy relative freedom from these troublesome emotions. These periods were always brought about by some achievement that had brought him recognition and praise from a peer, father surrogate, or other significant male. In those instances he felt independent, capable, and optimistic, and enjoyed alleviation of his guilt feelings. While discussing these occasional moments of remission, he mentioned quite casually that during these "good spells" his eyesight improved. Moderately myopic, he had worn glasses in those situations demanding especially good far vision since about the age of 13. The first instance occurred about two years previous to counseling after a pleasant afternoon with other boys hiking along a country road. While walking home, he noticed that everything around him seemed sharper, clearer, more distinct, and with enhanced three-dimensionality. He was not wearing glasses at the time. Most particularly, he felt that he could read a sign down the road that he was certain he could not have seen before. The feeling left in about 20 or 30 minutes, and his vision returned to its former state of relative blurriness and indistinction.

After two or three more experiences like this he came to accept them as a regular part of life and as, indeed, a kind of reward for having acted well. He felt that they did not of themselves impart to him any marked feeling of well-being, but rather that they came as one of the consequences of a general feeling of adequacy and well-being. In fact, he eventually came to use his phenomenally perceived state of visual acuity as a rough index of his state of mental health!

During therapy, the counselor had an opportunity to observe the course of therapy and to relate it to the client's stated perceptual condition. There was definitely a positive relationship; although the counselor did not press the matter, he did note that those sessions in which the client stated his vision was "poor" yielded less progress than those in which he described it as "good." The client's general mood corresponded to his perceptual condi-

tion also. It is hardly necessary to warn the reader, of course, that these are uncontrolled clinical observations that might easily be contaminated.

An opportunity arose to test empirically the "reality" and nature of the perceived visual change. By about three-quarters of the way through therapy, the periods of perceptual clearness were lasting for three or four days at a time, then alternating with equal periods of relapse into the former condition. The general level of his visual acuity had, the client felt, increased markedly. He was so convinced that there was a genuine change in his vision that he consulted an optometrist in the hope that he could get weaker glasses or discard them altogether. To his surprise, the optometrist, after a standard series of tests, informed the client that his eyes were in almost exactly the same condition they had been a year previous—at which time his perceptual world had been almost constantly "blurry." Here is an instance where the illusion was so strong as to convince the client that actual physical changes had taken place in the eye. As therapy came to a fairly successful conclusion, he talked less of his perceptual experience. His acuity seemed finally to settle at a medium position between the ultra-sharp clarity of some moments and the vague blurriness of others, still, however, fluctuating slightly with mood.

D. CASE 3

A 20-year-old freshman girl came originally for vocational guidance, but in the course of counseling formulated her problem as a broader one of lack of clear goals in life and a feeling of "not knowing where I stand or who I am." Later conferences brought to light fairly common but especially marked sexual conflicts and excessive emotional lability such as is often associated with hysterical disorders. The etiology rested on her parents' having separated while she was still a child of five and her having lived with her mother. A fairly strong sexual attraction to the father apparently persisted and led to her attempting to "seduce" older men by attracting their attention and exciting them sexually, but stopping short of intercourse because of sudden guilt and anxiety feelings. The latter generated a belief that others rejected and disliked her. The counselor was the same as for Case 2. Counseling lasted about seven months.

About halfway through counseling, the client recounted an experience she had had at one time about a year before beginning counseling. It was during a time of apparently spontaneous recovery and alleviation of symptoms. She had become interested in religion, probably as a means of handling her guilt feelings, and described the experience as a religious one. She

recounted it as follows, saying it came shortly after a period of meditation:

I suddenly felt an overwhelming feeling of love for everyone in the world. I had been thinking about a picture of Christ, and now I wanted to wash his feet with my hair; I don't know why, I just felt it. Then I went to the window [of an apartment building] and looked out and all the people, in fact everything I saw out there, looked different—sharp, clear, full of more color than I had ever seen, and separated in space; you know, they looked three-dimensional. I felt I could see into every one of their hearts. I felt, genuinely and sincerely, that I was somehow identified with every one of them.

The reader will immediately recognize the unmistakably hysterical flavor of this description, thus suggesting that the experience was not as "pure" a perceptual phenomenon as occurred in the first two cases. We might speculate that for some unknown reasons she had rather suddenly gained insight into the unrealistic nature of her guilt feelings and thus lost the concomitant feeling that others were rejecting her. The suddenness of the shift probably accounts for the almost overwhelming "oceanic" feelings of identification with all humanity, and so forth. A few days after describing the experience, she reported one almost identical to it that had taken place shortly after leaving the therapist's office. This one was almost exactly the same as described by the boy of Case 1, being practically devoid of hysterical overtones.

E. COMMENTS AND CONCLUSIONS

From these case histories that are in so many ways dissimilar, it would be foolhardy to assay any sweeping generalizations or far-reaching speculations. It is, however, possible to note certain striking features they have in common. Most obvious is the apparently illusory perception of greatly increased visual acuity and enhanced color and depth perception. Emotionally, the experience itself seems to generate only a kind of vaguely pleasant, to neutral feeling-tone; rather, it seems to *follow*, possibly as a consequence, to neutral feeling-tone; rather, it seems to *follow*, possibly as a consequence, moments of insight, realistic understanding of the essentially unrealistic neurotic conflict, and alleviation of symptoms. Cognitively, the client feels that his thoughts are clearer and more accurate, possibly because concepts and words may lose some of their former neurotic connotations. The only obvious similarity in etiology of the three cases is that in all there was a faulty father-child relationship, while the relationship with the mother was satisfactory.

It is worth noting that such a phenomenon has been noted at least once before. Elaine Dorfman (1, p. 252) reports a counseling session with an

adolescent boy during which he exclaims with surprise that some sort of "fog" has apparently lifted from the room. His manner makes it clear he was speaking of an actual illusion, not a figure of speech. Therapists whom the writer has questioned regarding this experience report that although it is an infrequent phenomenon it is by no means rare. One even has a standard reply, telling his clients to "enjoy it while you can."

The significance of the phenomenon is as yet unknown. While all three of the cases described here may be regarded as "improved" or even "much improved" other therapists say they have found no clear relationship between the occurrence or non-occurrence of the phenomenon and the outcome of therapy. All that we can conclude is that it is but one more manifestation, albeit a heretofore neglected one, of the recently established relationship between perception and personality. It is hoped that this report will encourage clinicians to note and explore its occurrence systematically and stimulate researchers and theoreticians to investigate and consider its significance, under well-controlled conditions, for our knowledge of perception and personality.

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FORM PERCEPTION AND SIZE CONSTANCY IN THE DUCKLING*

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A difficulty in obtaining information on the degree to which the perceptions of humans and higher mammals are influenced by factors of learning lies in their relatively slow postnatal maturation. As a consequence, maturational effects may be confounded with concomitant learnings of the animal in adapting itself to the environment. Experimental efforts to separate the two factors are not usually decisive because the animal is reared in a light-deprived environment; the restriction itself could impair maturational development. Another approach would be to secure information on the perceptual abilities of animals born or hatched in a relatively mature state.

Two Pekin ducklings, acquired within 24 hours after hatching, were the subjects of the experiments. In the procedure for form discrimination, the ducklings, upon leaving the cage, had to walk to a platform 12 inches away and knock over one of the three stimulus objects placed thereon for food in the well below. This task was learned in five trials. At first bread or cereal mash was the reward and subsequently, in the second week, bread crumbs. The reward averaged about 0.01 of an ounce. For the first four days the animals were kept hungry two hours and for the remainder of the experiment, six hours. Training proceeded until they lost interest in food. Two of the three stimulus objects were identical. Reward was always associated with the odd stimulus which was randomly varied over the three food wells, except when a position response was being broken. The usual learning criterion was 15 or more hits in a block of 20 trials.

After both birds had readily learned a preliminary color discrimination problem, training on form problems was begun 4½ days after hatching. This report is mainly concerned with the performance of the bird that seemed to show greater learning aptitude. The immediate question of interest is whether the duckling can distinguish a triangle from a rectangle. Isosceles triangles, rectangles, and other figures of various dimensions were cut from tin plate. The triangle, whatever its size, was always the rewarding figure. In the series of stimulus combinations, the animal proceeded

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from rectangles to trapezoids. It learned to select the triangle, regardless of variations in area and altitude, in 360 trials. No errors were made in the final 20 trials.

A more stringent test of the bird's ability to select a triangle from closely related figures seemed desirable. In selecting a triangle from a rectangle there is the possibility that the bird was responding on the basis of slope rather than triangularity of form (2, pp. 146 ff.). In the trapezoids already used the base angles were not controlled. In the final figures of this series a triangle with base and altitude of one inch and $1\frac{1}{16}$ inches respectively was set against one of three pairs of trapezoids. The base and base angles of two pairs were the same as those of the triangle with altitudes of $\frac{7}{8}$ inch or $\frac{15}{16}$ inch. The altitude and base of the third pair of trapezoids were equal to those of the triangle. At first introduced to readily discriminable stimulus combinations, the animal finally selected the triangle after 220 trials even when it was set against any pair of the above three pairs of trapezoids. No errors were made in the last 20 trials. This result was obtained 10 days after hatching. At age 20 days the bird was introduced to the problem of selecting a triangle when contrasted to rectangles or circles. These figures, which were of various dimensions and areas, were cut from black tape and affixed to rectangular tin plate backgrounds. The orientation and placement of all figures on the tin plate could be varied readily. The bird required only 20 trials to reach criterion in selecting an erect triangle from two rectangles; the figures were of equal areas. Subsequently, triangles, rectangles, and circles of differing areas and dimensions were introduced and rotated through various positions. The bird achieved 613 hits in the 820 trials spread over four days. Apparently it could select a triangle regardless of size, orientation, and placement on the tin plate except for that orientation in which the triangle was inverted and two squares were placed as diamonds. It is safe to assert that the animal was responding to the shape of the triangle as a whole.

The slower learning bird could only learn to select consistently the triangular tin plate when contrasted to rectangles after 700 trials. Both birds readily learned to select a stimulus with two broad horizontal stripes from a pair of identical stimuli with two vertical stripes each (30 trials to reach criterion for the "smart" bird, 100 for the other).

The first step in demonstrating size constancy was to train the bird to find food behind the larger of two objects which were initially equidistant from it (1, p. 88). The objects were cut from similarly grained wood. After the bird had learned to select the larger of the two objects their

relative distances and positions were varied in eight different ways. Since the distance of the large object in the far position was at least twice that of the small object in the near position it subtended an equal or a smaller retinal area. After 40 training trials the bird achieved all hits in a random sequence of the eight distance-position combinations in the next 20 trials. The original large stimulus was now paired with a new larger stimulus of similarly grained wood whose linear dimensions were twice as long. The bird directly transferred its response to the new large object (31 hits in 40 trials). These results were obtained 12 days after hatching. Three days later the set-up was transferred from the table to a floor seven feet square. Greater variation in distances and in the horizontal angles subtended by the two objects was now possible. A new pair of objects, enclosed on three sides, was prepared. The face of the larger one was a two-inch square and that of the smaller a one-inch square. The food was placed on a shelf inside the large object. In the final 25 of a series of 125 trials the bird made no errors. In these trials the bird selected the large object even though its distance of 80 inches was four times that of the small object. It should be added that the bird took a more or less straight line path to the large object without investigating or approaching the small object.

The foregoing results strongly suggest that basic perceptual functioning in the duckling is due to autochthonous factors. The presumption that similar functioning in higher phylogenetic organisms shares a common causation is increased. Moreover, these results show the usefulness of the duckling as a laboratory animal. Further experiments on other aspects of perceptual functioning in the duckling are now in progress and will be subsequently reported.

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LYSERGIC ACID DIETHYLAMIDE (LSD-25): XXVI. EFFECT ON SOCIAL ORDER OF THE FIGHTING FISH, *BETTA SPLENDENS**

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A. INTRODUCTION AND PROBLEM

LSD 25 is known to induce nine characteristic overt effects upon the fighting fish, *Betta splendens* (1). Eight other ergot drugs were also tested for their effects upon *B. splendens* (11). Seven of these induced fin display: BOL 148 (monobrome derivative of LSD 25), LAE 32 (d-lysergic acid ethylamide), d-lysergic acid, l-LSD 25, d-iso LSD 25, ergonovine and ergotamine. Results with dihydroergotamine were negative. Mescaline and demerol were also utilized but only the former elicited fin display.

While conducting preliminary experiments it was discovered that as an after-effect, LSD 25 appeared to intensify the aggressiveness of the species. The purpose of this paper is to present evidence that LSD 25 does influence instinctive behavior, especially combativeness.

To understand more clearly the social pattern of *B. splendens*, it is well to examine briefly the natural environment in which this small fish has evolved. Bettas are plentiful in the rice paddies and stagnant pools throughout Siam and neighboring provinces. In shallow water wherein plant growth is luxuriant the species has developed a unique ethology (12). Pugnacity is an integral part of this behavior and is believed to persist throughout the life of the individual. Among juveniles, it would appear that hierarchies exist in which those of higher dominance rating, determined by previous combats, take precedence over others and assert this authority by chasing, fin display, tail-whipping, and biting. As the male matures, it leaves the school to seek a limited area in which to dwell.

In such a territory the male soon constructs a bubble nest, attracts a female, and later jealously guards the eggs and fry. The eggs, as deposited by the female, are gathered up in the male's mouth and directed in a stream into the mass of bubbles at the surface. After hatching, the offspring hover beneath the nest where, under the protective eye of the parent, flocking first

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appears in the life of the species. The male appears to be at least partly responsible in initiating the herding habit, for as the tiny fish darts away from the brood, the male sucks it into his mouth and literally squirts the fry into the flock. Until the youngsters are able to fend for themselves, the parent is known to conduct them on short excursions presumably within the boundaries of his home area.

Whether the cohesive flocking pattern of the juveniles persists after the male parent relinquishes guardianship is not positively known. We have noted that when as many as 50 young Bettas are kept in a single large aquarium containing little or no foliage, they are very prone to form a close flock which moves slowly about the tank as a unit. When one fish pursues another, the latter breaks from the group momentarily but quickly returns. However, if heavy plant growth is present, the juveniles spread out as each occupies a separate "niche" that partly hides it from close neighbors. Niche-holders chase intruders from their boundaries. Instead, a fish that might wander through the aquarium will be pursued in turn by the occupant of each circumscribed territory through which the wanderer might pass.

No information appears to be at hand with reference to the wild adult female except that when ripe she visits the home area of a male for procreative purposes. It is presumed that she departs after ovipositing since the male appears to take over the tasks of the nursery and is known to drive the spent mate away from the nest area. Small groups of adult and sub-adult females in aquaria usually form more or less straight-line hierarchies, suggesting the tendency to flock when not involved in the egg-laying ceremony. The adult male is usually too pugnacious to allow any male companions within his territory which he appears to maintain regardless of season, at least in the laboratory. We are in need of field observations concerning the sociability of the male.

Our studies of older females revealed four facets in the pattern of aggression which became apparent in long-established hierarchies. These are as follows:

1. Chasing. This is usually by means of swift dashes, with the mouth open.
2. Biting. If the pursurer is fast enough, it will succeed in ripping a fin or displacing several body scales of its opponent.
3. Tail-whipping. If two fishes appear to be evenly matched in aggressiveness, they will be observed to come to rest side by side only to lash their tails against one another. The outcome might find one gradually

pushed back and then chased by the victor, or the fighters might stop and repeat the maneuver at a later moment.

4. Fin display. This type of intimidation is the most common and is especially easy to observe for a fish usually slows up and maneuvers to a position beside or in front of another before spreading its fins.

Antagonism between two adversaries is usually initially observed as posturing with fins widely extended. If neither retreats, then tail-whipping may ensue or one might even dart swiftly at the other. Biting appears to be the most extreme type of combativeness and the least common, but before dominance of one over another has been established, mutual biting commonly occurs.

The releasers that play a major rôle in the intraspecific social behavior of *B. splendens* are chiefly associated with vision. This does not suggest that auditory, osmotic, and tactile stimuli are ineffective in the ethological activities of this species. It does mean that the spreading of the fins profoundly affects the mutual social pattern of mates or rivals by virtue of the visual impact of the display upon the central nervous system, whereas the other sensory modalities play a distinctly minor rôle.

The typical display pattern of the fighting fish consists in the erection or spreading of the dorsal, ventral, and caudal fins as well as the pelvics, which are pointed downward and resemble crimson swords. It is evident that display occurs only as a social gesture. In isolation the Betta very rarely extends its fins, especially the pelvics. In fact, it has been our experience that the latter are brought forward only as an intimidatory or courting gesture and always accompanied by the erection of the other fins. However, momentary display of all except the pelvics occurs not infrequently in random swimming activities.

Two display postures, lateral and frontal, are assumed by a normal adult male as he approaches another adult or near-adult of the same species. In the frontal approach the male comes toward the mate or rival head-on with the branchiostegal rays and operculae spread. With mouth open and a dark red fringe projecting around the head like an Elizabethan frill, the fish presents a spectacle indeed. The fins are usually spread but are sometimes partially furled. In the lateral posture the operculo-hyoid apparatus is not utilized but the fins are widely spread and the fish approach one another at an angle, slowing up as they come alongside. They circle, turn and sweep, always drawing nearer in such a manner as to make visible their mutual fin display.

While immersed in solutions of *LSD* 25, the frontal display involving the

hyoid apparatus is rarely if ever elicited. At least we have never observed it. However, in the period following the administration of *LSD* 25 the Betta exhibits frontal and lateral posturing with equal frequency and intensity. In fact, one very characteristic after-effect of the substance under consideration is the increased pugnacity of *B. splendens*.

This species exhibits a typical habit of rising frequently to the surface to emit and take in bubbles of air through the mouth. Occasionally bubbles can be seen streaming out from behind the operculum as the fish descends. This habit as well as the type of bubble nest which the parent creates appear to be related to the ecological niche in which the species occurs in Siam. It would seem that the oxygen tension of such waters might be relatively low. This is important in connection with the value of Bettas when used as bioassay subjects in the study of ergot derivatives and related drugs.

B. TECHNIQUE

The hallucinogen *LSD* 25 was usually administered by immersing fish in dosages ranging from 1 gamma to 50 gamma/ml dissolved in water. An occasional fish was inoculated intramuscularly with relatively massive doses. The immersion method of drug treatment proved entirely satisfactory, producing trauma or other observable effects not directly associated with *LSD* 25.

The water used in all experiments was from a local spring. It was stored in a 30-gallon glass tank. The temperature of liquids in which fish were placed was adjusted to within one degree *F* of that from which they were taken.

C. EXPERIMENT I

1. Procedure

Four social hierarchies of *Betta splendens* were studied. Individuals in each group were identified by specific color patterns. Tank *C* contained six adult females. Tanks *A*, *B*, and *K* contained, respectively, four, seven, and five juveniles (one inch from snout to base of tail). In order to ascertain as nearly as possible the effect of *LSD* upon fish behavior, two periods of observation were planned. In the first or pre-treatment period, the performance of each individual in each hierarchy was carefully noted and compared with that in the post-treatment interval, after *LSD* had been administered to one member of each group.

When a group is newly formed all four of the objective criteria of dominance are elicited, namely fin display, chasing, biting, and tail-whipping. After the fishes had become socially "static" the most usual form of aggres-

sion appeared to be chasing. The figures given in Table 1 pertain to occasions when an individual was observed to exhibit any one of these four criteria. The upper horizontal rows of digits relate to the pre-treatment period, the lower rows of digits pertain to the post-treatment interval.

2. Results

Tank *C* (Hierarchy 1, Table 1). Between July 1 and July 18, 1954, the fish in this tank aligned themselves socially in order of precedence as follows: *A*, *B*, *D*, *C*, *E*, and *F*. On July 11, Female *C* was injected intramuscularly with 50 gamma *LSD* 25. She appeared to recover completely from this massive dose and was returned to Tank *C* on July 18.

In reading the data given in Table 1 pertaining to Tank *C*, for example, we note that Female *A* scored a total of 131 aggressive contacts against the other five fish in the pre-treatment interval and 14 in the post-treatment period. In contrast, the respective scores for Female *C*# were 100 and 58. More specifically, it is observed that the score of Female *A* against *C*# was 19 contacts before July 11 and only one after July 18, while that of *C*# against *A* was 11 before receiving *LSD* and 18 afterward. The score of Female *B* against *C*# in the first and second periods, respectively, was 22:0. This compares with 2:11, the score of *C*# against *B*. The more unusual record of 55:1 of female *D* against *C*# compares with *C*#'s score of 45:18 against *D*.

The data given in Table 1 for Tank *C* emphasize the rather commonly observed phenomenon that a particular member of a hierarchy makes more contacts with its immediate neighbors in rank than with those more removed socially. Thus, in Period 1, Female *A* attacked Females *B* and *D* more frequently than Females *C*#, *E*, and *F*, whereas *C*# centered her attacks upon *D*, *E*, and *F*. Female *D* also exhibited more antagonism toward the lower members of the hierarchy than toward Females *A* and *B*.

In the post-treatment period we find that Female *C*# shifted the burden of her attacks away from the lowest members of the group and toward the higher ranking individuals of the hierarchy, especially Females *A* and *B*. But despite the fact that Female *C*# attacked Fish *D* less than half as often as in Period 1, she was attacked once only by Fish *D*. It is perhaps significant that the threshold of hostility was raised more in Female *D* than in Females *A* and *B*, whereas, of course, it was lowered markedly in Female *C*#. Although the narcotized Fish *C*# established approximately one-half as many social contacts in the second period as in the first, the average number of contacts scored by the five untreated fish dropped from 85 in the

first period to 8.4 in the second. The probable alignment of individuals in Hierarchy 1 on August 17, in order of social precedence, was *C*#, *B*, *A*, *D*, *E*, *F*.

Tank *A* (Hierarchy 2, Table 1). In comparing the scores of the four juveniles both before and after August 15 (when Fish *D* had been immersed in 25 gamma/ml of *LSD* 25 for 60 hours), it will be observed that Fish *D* was affected by the drug to the extent that its tally rose to 19 contacts compared with 0 before treatment. It is interesting to note that Fish *D* was more than twice as aggressive toward Juvenile *C* as toward the higher ranking individuals *A* and *B* between August 15 and August 30. It would appear that *D*# had risen from the bottom of the hierarchy to supplant Fish *B* as the top-ranking member on August 30.

Tank *B* (Hierarchy 3, Table 1). Although the Juvenile #*E*' scored no contacts against the others in the tank before August 15, its total after being immersed for 60 hours in 25 gamma/ml of *LSD* 25 was 19. Of these 19, 15 contacts were scored against fishes that had ranked above #*E*' before August 15. The score of #*E*' after August 15 is comparable to that of Juvenile *A* before August 15. It is evident that by August 30 Juvenile #*E*' had risen from fifth to first position to displace Juvenile *A*. The order of rank of the other five members of the group is unknown after August 15, since none exhibited aggressiveness after this date.

Tank *K* (Hierarchy 4, Table 1). Although Juvenile *E*# established no contacts against any opponents in the first period, it was decidedly aggressive after receiving *LSD* 25 (administration the same as in Tanks *A* and *B*). In fact, it scored more than twice as many contacts as the total recorded by the other four fishes in Tank *K*. In view of the former supremacy of Juvenile *B*, it is interesting that the treated Fish *E*# attacked it with greater frequency than any of the others in the second period. A statistical analysis (*T* test) of the data presented in Table 1 indicates that the probability of obtaining by random sampling the difference in means of control and experimental animals is $P > 0.01$: $T = 3.09$.¹

D. EXPERIMENT II

1. Procedure

In another experiment five groups of four juveniles (one inch in length, snout to base of tail) each of *Betta splendens* were secured. The fish of Group 1 were retained as controls in Tank 1. The fish of Groups 2-5 were

¹To Dr. Max Hamburg our thanks are due for his kind assistance in the preparation of this analysis.

immersed for six hours in spring water to which was added the following amounts of *LSD* 25: Group 2, 1 gamma/ml; Group 3, 5 gamma/ml; Group 4, 25 gamma/ml; Group 5, 50 gamma/ml. These groups were then removed from the *LSD* solutions, rinsed in spring water, then placed in Tanks 2, 3, 4, and 5, respectively.

TABLE 1

TANK C ADULT FEMALES						
A	B	*C	D	E	F	
A	50 6	19 1	43 6	13 1	6 0	131 14
B	35 12	22 0	59 2	4 5	11 2	131 21
*C	11 18	2 11	45 18	16 4	26 7	100 58
D	12 1	15 1	55 1	20 1	32 0	134 4
E	0 2	2 0	3 1	2 0	5 0	12 3
F	0 0	0 0	11 0	0 0	2 0	13 0
Contacts (July 1-July 18)						521
(July 18-Aug. 17)						100
Grand Total						621

*C Female injected with 50 gamma *LSD* 25, July 11. Female C returned to tank C July 18.

TANK B JUVENILES							
A	B	C	D	#E'	F	G	
A	6 2	4 1	2 2	4 1	0 1	4 1	20 8
B	1 0	3 0	1 0	0 0	0 0	0 0	5 0
C	1 0	0 0	2 0	0 0	0 0	0 0	3 0
D	0 0	0 0	0 0	1 0	1 0	0 0	2 0
#E'	0 4	0 2	0 6	0 3	0 1	0 2	0 19
F	0 0	0 0	0 0	0 0	0 0	0 0	0 0
G	1 0	0 0	0 0	0 0	0 0	0 0	1 0
Contacts (August 1-15)							31
(August 15-30)							27
Grand Total							58

TANK K JUVENILES				
A	B	C	D	#E
A	2 4	0 2	1 1	1 3
B	5 0	0 6	1 5	3 5
C	3 0	0 1	0 0	0 1
D	0 0	0 0	0 0	0 0
#E	0 7	0 16	0 11	0 10
Contacts (Aug. 1-15)				16
" (Aug. 15-30)				78
Grand Total				94

TANK A JUVENILES				
A	B	C	#D	
A	1 0	2 0	3 2	6 2
B	5 1	3 2	2 2	10 5
C	0 0	0 0	2 1	2 1
#D	0 5	0 3	0 11	0 19
Contacts (Aug. 1-15)				18
" (Aug. 15-30)				27
Grand Total				45

On the eighth, ninth, and tenth days after the date of immersion in *LSD*, the fish in Groups 2-5 were observed and compared with those in Group 1 for three-hour periods of continuous scrutiny. When any of the four criteria of social aggression utilized in this study was detected (chasing, display of fins, biting, tail-whips) it was tabulated (Table 2). No attempt was made to identify individual specimens with specific acts of aggression. Rather, it was planned to note the total number of social contacts which were ob-

TABLE 2

The effects of different dosages of *LSD* 25 upon the aggressiveness of juveniles (*Betta splendens*) as observed on the eighth, ninth, and tenth days after treatment during three 3-hour periods of continuous observation. The three columns shown for each tank represent the observations on the 8th, 9th, and 10th days.

Contacts	Tank 1 Controls			Tank 2 1 gamma/ml*			Tank 3 5 gamma/ml			Tank 4 25 gamma/ml			Tank 5 50 gamma/ml		
Chasing	13	15	11	22	16	19	40	45	32	46	40	52	51	54	48
Display	4	10	13	17	12	16	40	31	43	73	64	70	42	48	39
Biting	0	0	0	2	0	1	5	3	4	9	10	8	5	5	2
Tail Whips	1	1	1	2	1	3	2	2	2	0	0	0	0	0	0
Totals	18	26	25	43	29	39	87	81	81	128	114	130	98	107	89
Averages			23			37			83			124			98

*See P. 269.

served in each of the five tanks in a 3-hour interval. This method gave the opportunity to study the after-effect of *LSD* upon 16 individuals instead of only four as was the case in Experiment I.

2. Results

The results obtained in Experiment II confirm those of Experiment I and indicate that *LSD* has a positive after-effect upon the aggressiveness of *B. splendens* and reveal a clue as to what concentration of the drug might prove most effective in future experiments.

a. *Chasing*. In Table 2 is shown the after-effect of *LSD* upon the number of episodes of chasing observed. But while an average of 51 chases occurred at the 50-gamma level of the drug per ml, 39 were recorded at the 5-gamma level compared with 13 for controls. However, the most effective dosage in relation to the number of chases recorded was found to be 1 gamma per ml, with 32 per cent more contacts than for the controls. By increasing the concentration of *LSD* to 5 gamma, the number of chases was doubled, while at 25-gamma level, the number of contacts was only 5 per cent above that at the 5-gamma dosage.

b. *Display*. The consequences of the administration of *LSD* are shown

in the records of contacts involved in fin display (Table 2). Compared with the average of 9 contacts noted for the controls, averages of 15, 38, 69, and 43 were established for the fishes in Tanks 2, 3, 4, and 5, respectively. Assuming that the number of social responses was proportional to the concentration of *LSD* administered, we should expect 75 displays at 5 gamma, 375 at 25 gamma, and 750 displays at 50 gamma.

c. *Biting*. The number of bites recorded during the nine hours of observation was small. None was noted among controls, and at each of the following levels of *LSD* concentration, namely 1, 5, 25, and 50 gamma, we counted an average of only 1, 4, 9, and 4 bites, respectively. The paucity of observations on biting in this experiment might be interpreted as indicating that this relatively extreme form of aggression was of rare occurrence in the species. On the contrary, biting is a common aspect of *Betta* combat as shown in a recent study (2). It is quite possible that when the five groups were established seven days before the periods of observation began, biting was prevalent; for that was when hierarchies were forming and before social rank had become fixed. Once established, a fish in a superior social position was usually able to maintain it henceforth by intimidation-display or at most by chasing.

d. *Tail-Whips*. Although the number of tail-whips observed was, like the number of bites, too small for serious consideration the fact that the former were noted only in Tanks 1, 2, and 3 while biting was more common in Tanks 3, 4, and 5 suggests that biting persists at a low threshold of combat and whips prevail at a high threshold.

In Experiment II the general after-effect of *LSD* upon the fighting fish can best be emphasized by stressing the fact that the mean number of aggressive contacts credited to those to which the drugs had been administered was 3.6 times as great as that of the controls.

E. DISCUSSION

The facts presented indicate that one important after-effect of the administration of *LSD* 25 is the lowering of the combat-threshold. Does the drug "trigger" the central nervous system more or less permanently to respond to external stimuli at a lower impact level than normal? We raised this point at a recent Symposium, where it was argued that *LSD* produced a temporary effect only and during this interval of narcotization the individual became established in a higher social position which was held long after the direct drug-effect had disappeared, merely by virtue of the acquiescence of others in the group (10).

This argument overlooks the following points: (a) When a Betta that has hitherto occupied a secondary position rather suddenly confronts one of higher status with a show of resistance, the latter does not always acquiesce. Rather, it often becomes increasingly aggressive in an effort to maintain its rank (see Table 1, Tank K). This is even more common in the eastern newt, *T. v. viridescens* Raf. (8, 9). (b) Moreover, the Betta, like the newt, continually tests the degree of antagonism of fellow members in the hierarchy. The formerly narcotized individual which now ranks above its former level, can only maintain this level by a continual show of aggression. This would be most unlikely if the *LSD*-effect upon the central nervous system was of temporary duration.

A third point to be emphasized lies in the fact that when an individual is removed from its hierarchy and then readmitted, a new alignment of rank takes place during which the individual concerned often fails to regain its former status, indeed may be forced into a lower one.

In the face of this situation, a narcotized fish has, of course, an even greater struggle to *improve* its social status upon returning to the group. Yet this it slowly succeeded in accomplishing, despite the fact that it happened to be slightly smaller than former higher ranking rivals. Size of adversaries has not been emphasized in this report, however in our work with fish (10), amphibia (8, 9), and reptiles (3, 4, 5, 6, and 7), we have not observed a single instance where a smaller individual actually supplanted a larger one in a social hierarchy by virtue of its greater ferocity, except by the administration of hormones or *LSD* 25. These lower vertebrates appear to possess such visual powers as to detect what appear to the human eye as extremely minute differences in size. We repeat, it appears most unlikely that the post-treatment success of the narcotized fish rests upon a short term effect of *LSD* or on the acquiescence of former larger and higher ranking members of the group.

F. SUMMARY

This report has emphasized the after-effect of *LSD* 25 upon the aggressiveness of the fighting fish. Whether the drug is administered to all the individuals in a social hierarchy or only to one of the lower ranking members of the group, the results indicate that narcotized fish are more aggressive than controls.

The evidence reveals that after treatment with *LSD*, a low-ranking individual rises in the social hierarchy by virtue of its increased hostility. Out of 1,911 aggressive contacts recorded, 1,266 were imparted by 20 individuals

to which LSD had been administered. Four of these served as their own controls since their scores before and after treatment were compared. A total of 645 aggressive contacts were made by 22 controls.

It was observed that a member of a hierarchy usually exhibits greater hostility toward one that stands immediately below it in rank than toward an individual that ranks several steps lower socially. This phenomenon was especially evident when a fish of low status shifted its attacks to high ranking members after treatment with LSD.

The degree of aggressiveness was established by counting the number of contacts occurring between individuals such as bites, chasing, fin-displays, and tail-whips. Chasing and fin-display accounted for the great majority of hostile contacts recorded.

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CHANGES IN THE LEVEL OF BLOOD SUGAR AND SENSORY AND MOTOR PERFORMANCE BROUGHT ABOUT BY INSULIN COMA THERAPY*

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A. INTRODUCTION

This is a report of further findings obtained from a project which provided the data for two previous publications (1, 3). We have shown that the scores for flicker-fusion threshold (*CFF*), choice reaction time (*CRT*), and speed of tapping (*Tap*) are significantly changed in a majority of patients subjected to psychosurgery (*OP*), electric convulsive therapy (*ECT*), and insulin coma (*IC*) therapy. These changes could be demonstrated either by the trend of successive measurements made on each patient before, during, and after treatment, or by comparing the averaged scores of the patients treated by *OP*, *ECT*, or *IC* with those obtained over a like period of time from patients who received no form of physical treatment.

In particular we reported that: "The majority of patients who were treated with a series of induced insulin comas showed a progressive loss in their flicker-fusion threshold so that a significant decrease was found at the end of treatment. A similar change was found in the decision reaction time scores. The other test scores were not significantly altered by insulin coma therapy" (1, p. 304). The significance of this finding was limited by the fact that it was based on a study of a small group of 13 insulin coma patients on whom blood sugar level determinations were not available. It seemed possible that the changes might be due to either the cumulative effect of many insulin-induced comas or to the immediate effect of the insulin on the level of blood sugar at the time of the particular test session.

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B. PURPOSE

With somewhat modified apparatus we hoped to obtain further information bearing on changes in psychological test scores which might be obtained during and after insulin coma therapy. We also desired to find whether changes in test scores were a reflection of the blood sugar levels at the time of the test administration or of a progressive physiological change brought about by a series of insulin comas.

C. APPARATUS AND METHOD

1. *Flicker-Fusion Threshold Apparatus*

In most of our investigations involving *CFF* we have employed the method of descending thresholds, i.e., the directions given to patients were: "Press the switch to turn out the light as soon as it seems to flicker." We used this method since looking at a steady light is not as annoying as looking at a flickering light. Thinking that we might increase the sensitivity of *CFF* as an indicator we modified our *CFF* equipment so that we might use both the ascending and descending thresholds, an illuminated surround for the test patch, and three levels of test patch luminance. The new equipment was somewhat similar to that previously used (2, 3).

The control panel of the modified apparatus provided a means of (a) selecting an ascending or descending direction of change of rate of intermittance, (b) controlling the starting frequency, (c) initiating a trial by turning on the light and starting the intermittance, i.e., the "Start" button, (d) extinguishing the light and stopping the driver, i.e., subjects' "Stop" button, and (e) clearing and resetting the driver. The lamp was a small spiral fluorescent tube (Aristo Grid Lamp) which illuminated a round test patch of flashed opal glass whose image subtended a visual angle (v.a.) of 3.0° at the cornea.

The experimenter preset the starting frequency and direction of change and then pressed the "Start" button. When the observer saw the test patch change in appearance from flicker to steady, or vice versa, he pressed the "Stop" button. This stopped the lamp control circuits, locked the oscillator frequency, and opened a one-second pulse gate. This gate fed the oscillator output to a digital electronic counter for exactly one second and a "Digital Read-Out" displayed the threshold frequency in cycles per second, reading to 0.1 cps. When the experimenter had recorded the threshold determination he pushed a "Reset" button which cleared the digital display. He then set the desired starting frequency and direction of change and pushed

the "Start" button again. Each determination took 5 to 10 seconds of elapsed time. The entire field of regard (surround plus test patch) subtended 30.0° v.a. The area surrounding the test patch was illuminated by a circular fluorescent lamp operated on direct current which reflected light from a mat surface white cardboard which surrounded the test patch. The luminance of this surround amounted to 50 ml. The test patch luminance could be changed by the insertion of either a log 1.0 or log 2.0 neutral density filter. The test patch luminance (Talbot) was 350, 35, or 3.5 ml. At each test session 10 ascending and 10 descending thresholds were determined for each of the three levels of luminance, binocular view.

2. Choice Reaction Time Apparatus

The equipment and method described in a previous report (1) was used. It was modified so that a delay of two seconds of time always elapsed between the "Ready" signal and the "Start" signal. The score on this test was the number of milliseconds which elapsed between the flash of the "Start" signal lamp and the completion of the contact between the finger and the target plate. (Larger numerical values indicate slower reaction times.)

3. Speed of Tapping

We followed the method used in a previous report (1) where each speed of tapping test measure is a part of and follows each *CRT* measure. The finger contact on the target button which closed the time gate for the reaction time, opened a second time gate for Tap measure which continued operating until the twentieth tap contact was made. The tapping involved touching alternately two metal contacts, each 77.5 mm in diameter, whose centers were 155 mm apart. Between the metal contacts was a wooden barrier, 10 cm long and 4 mm square, over which the finger had to be moved. The twentieth tap contact acted to close this gate and the read-out display showed the elapsed time between the first and the twentieth contact in milliseconds. This figure constituted the speed of tapping score. (Larger numerical values indicate slower speed of tapping.)

Twenty *CRT* and Tap determinations were made at each test session, using the same hand each time. The first five determinations in each series of 20 were considered as "warm-up" trials and were not included in our calculations. The *CRT* and Tap scores are therefore the mean of 15 trials at each test period.

D. SUBJECTS AND TEST CONDITIONS

The test equipment was arranged in a room on the insulin treatment service at Creedmoor State Hospital, New York City. We obtained valid measures on three or more occasions from 47 psychiatric patients who underwent insulin coma therapy; we twice obtained test scores (Pre-1 and Pre-2) before the therapy was started in 38 of the 47 patients. All tests were given one, two, and four weeks after the therapy was ended (Post-1, Post-2 and Post-3) with 36 of the 47 patients. During the course of the treatment each patient was tested after about 10, 20, 35, and 45 comas, and again on the day of the final coma; these tests we call During-1, During-2, During-3, During-4, and Final-coma; respectively. The total number of actual comas had varied from 13 to 89 among different individuals. Complete Pre-, During-, and Post-data were obtained from 28 patients. The difficulties attendant on the analysis and presentation of "fragmentary" data of this sort were discussed in a previous article (1, pp. 282-3). In the present analysis we have used the complete data, i.e., all measures available whether or not the data were obtained from the same patients.

During *IC* treatment the insulin was injected five times a week at about 7:30 A.M. each day. The ensuing coma was terminated by injection of glucose about 10:30 A.M. As soon as the patient was mentally clear (usually between 11:00 and 11:30 A.M.) the battery of tests was given. Whenever possible the tests were, in part, repeated during the afternoon of the same day (1:00 to 2:00 P.M.) which was about two hours after termination of coma and after a high carbohydrate noon meal.

The divided insulin dose method was used in bringing about coma. The smallest amount of insulin that would produce coma in each patient was empirically determined and represented the total dose given at each subsequent treatment. The amount having been found, the insulin was given in divided doses, for example, 70 units might be injected in three doses of 30, 20, and 20 units with 15 minutes elapsing between successive doses. Coma was terminated by the intravenous administration of 50 cc of 33 per cent glucose solution. In a very few instances when the coma seemed more procc than usual, i.e., seemed to have gone beyond the third depth level, 0.25 cc of adrenalin was administered at varying time intervals before the glucose was given. Separate analysis of these instances, where adrenalin had been given, failed to indicate that the adrenalin had any regular effect on the subsequent psychological test scores or on blood sugar level at the end of coma.

All patients in the present study had a diagnosis of dementia praecox.

The outcome of the insulin treatment was rated by the physician in charge of the service as: (a) definite improvement, likely to stay out of the hospital, to be placed on convalescent care; (b) doubtful improvement, may be able to stay out of hospital while on convalescent care; and (c) unchanged, transfer to another ward for other treatment. The number of patients in each outcome group by sex and age is given in Table 1. The condition and progress of all patients was closely followed during their stay on the insulin ward.

TABLE 1
THE NUMBER OF PATIENTS BY AGE AND SEX WITH RESPECT TO OUTCOME OF
INSULIN COMA THERAPY

Outcome	No.	Male Ave. age	Range	No.	Female Ave. age	Range	No.	Total Ave. age	Range
1	4	30.2	18-41	6	28.6	19-36	10	29.4	18-41
2	15	24.7	16-39	10	30.5	23-44	25	27.0	16-44
3	7	25.4	18-38	5	32.6	23-37	12	28.4	18-38
Total	26	26.5	16-41	21	30.4	19-44	47	28.3	16-44

E. RESULTS

1. Sex, Age, Practice

Since our data were collected from both men and women who varied in age from 16 to 44 years and who had repeated the tests from 5 to 11 occasions, we examined the scores on each test to see whether or how much of the variability could be attributed to sex, age, and practice. Age and the mean of all of the *CFF* threshold measures for each individual correlated -0.35 ($P < .05$). Age was not correlated with the *CRT* or Tap measures.

The mean *CFF* score of each individual was not related to sex but there was a significant difference ($P < .01$) between men and women for both the mean *CRT* and mean Tap scores, the men having average scores indicating faster performance on both tests. These sex differences in *CRT* and Tap scores did not bias the group means or *SD*'s since the number of men [26] and of women [21] was not too disproportionate. The *CFF* gave no evidence of practice; while both the *CRT* and Tap scores did show practice effects.

2. Blood Sugar Level

Blood samples were drawn by a technician on each of the days our tests were administered. Using the Folin-Wu method, the blood sugar level of each sample was measured and expressed numerically in milligrams-per cent (mg%) by volume.

On the Pre- and Post-test days blood samples were taken at 7:00 A.M. and just after our test battery was completed. At each of the During-test days five samples were secured. (a) A *fasting* sample at 7:00 A.M. (no breakfast) before the injection of insulin, (b) one hour after insulin injection, (c) just before the termination of coma with glucose, (d) at the completion of our test battery, i.e., about one hour after coma had been terminated, and (e) after luncheon, i.e., two to three hours after coma.

Although the administration of insulin produces hypoglycemia which leads to the coma, the blood sugar level is not a particularly good indicator of depth of coma. The injection or ingestion of sugar during coma raises the blood sugar level and usually brings about a return to consciousness. In general the blood sugar level is associated with the amount and recency of food ingestion, particularly carbohydrate ingestion. The level of blood sugar is lowest (all other things being equal) during the morning hours before breakfast. The determinations made at this time are called fasting levels and are said to be "normal" when they fall within the range of 80 to 110 mg%.

A tabulation of the means and *SD*'s of the blood sugar levels expressed in mg% for the different test sessions was made, part of which is given in Table 2. The blood sugar entries in Table 2 are the means of the determinations made after each test session. The Pre- and Post-entries are averages made in late morning, approximately two hours after breakfast. The During-entries are averages made in late morning when no breakfast had been taken but after insulin coma treatment followed by revival by the injection of glucose. All During-measures are lower than any one of the Pre- or Post-means but because of the large *SD* the measures are not statistically significant with the exception of the change between Final and Post-1 which is significant at the $P < .01$ level. The remainder of the tabulation showed that the mean of the fasting levels remained in the normal range throughout all test periods while the *SD*'s indicated a relatively small variability.

A survey of the findings during the course of this experiment indicated little relationship between the blood sugar levels and the figures which we were obtaining with the other tests. In order to clarify this point we collected further data on a separate, or control group of patients. Sixteen patients who had had two to 33 comas and were still in treatment were selected as controls.

With this group *CFF* (both ascending and descending series at 35 ml luminance only), *CRT*, *Tap*, and blood samples were obtained: (a), in the morning before insulin injection; (b), one hour after insulin injection,

TABLE 2

THE NUMBER OF PATIENTS, MEAN, AND STANDARD DEVIATION FOR THE TEST SCORES AT EACH TEST SESSION

The *CFF* scores are expressed as cycles per second of intermittence of light. The reaction time score is the number of milliseconds elapsing between the start signal and the end of the response. The tapping score is the time in seconds to accomplish 20 taps. The blood sugar is mg% by volume.

		Test session									
		Pre-1	Pre-2	During-1	During-2	During-3	During-4	Final coma	Post-1	Post-2	Post-3
Comas	N	0	0	10	20	30	45	46+	—	—	—
Flicker-Fusion	N	38	35	36	37	38	31	35	33	32	30
	M	43.3	42.9	41.2	41.5	41.3	41.4	41.3	42.8	43.1	43.6
	SD	3.6	3.6	2.9	2.5	2.6	3.0	2.6	2.2	3.5	2.0
Reaction Time	N	31	34	33	36	32	30	28	32	31	29
	M	.78	.77	.78	.77	.82	.79	.77	.75	.74	.75
	SD	.12	.15	.21	.12	.12	.15	.18	.13	.13	.13
Tapping	N	34	34	33	36	32	30	28	32	30	28
	M	4.30	4.10	4.20	4.12	4.17	4.07	3.94	3.93	3.85	3.87
	SD	.68	.68	.90	.71	.75	.79	.67	.60	.53	.53
Blood Sugar	N	18	19	20	23	22	25	24	28	24	24
	M	109.0	103.0	85.0	93.0	96.0	88.0	94.0	111.0	106.0	108.0
	SD	13.0	30.0	29.0	36.0	38.0	30.0	36.0	12.0	27.0	16.0

and before coma; (*c*) one-half hour after termination of coma; and (*d*), two hours after termination, and after luncheon. (Blood samples were not taken at the *d* period.) The results are summarized in Table 3.

This tabulation indicates that *CFF* (either ascending or descending) changes very slightly but not significantly when the mean blood sugar drops markedly as is shown by comparison of Columns *a* and *b*. The coma itself (compare Columns *a* and *c*) does drop *CFF* significantly at $P < .02$ level. The longest (slowest) choice reaction time and tapping time occurred when the blood sugar was lowest (note Column *b*). For the *CRT*, only *a* and *b* differed significantly ($P < .05$), while for the Tap, both *b* and *c* were significantly slower (longer) ($P < .01$ and $.02$, respectively) than *a*.

TABLE 3
THE MEANS OF BLOOD SUGAR LEVEL AND THE TEST SCORES FOR THE CONTROL GROUP

Test period	Units	<i>a</i> Fast	<i>b</i> Pre-coma	<i>c</i> Post-coma	<i>d</i> Afternoon
<i>CFF</i> (ascend)	cps	42.7	42.9	41.6	42.6
<i>CFF</i> (descend)	cps	44.2	43.2	41.3	43.5
<i>CRT</i>	ms	.76	.87	.83	.76
Tap	secs.	4.09	4.58	4.29	4.03
Blood sugar	mg%	109	44	106	—

3. Choice Reaction Time and Tapping

The correlation (Pearson) between these *CRT* and Tap scores in the present study was $r = 0.80$ which agrees with the findings in our previous studies. Both of these tests are subject to considerable practice effect, that is, there is a clear tendency for the elapsed time in milliseconds to decrease for both the *CRT* and the Tap with successive repetitions of the tests. We have shown previously that there is a tendency for active therapy (insulin, *ECT*, psychosurgery) to interfere and, in some individuals, to reverse the practice effect during the period of and immediately after the applications of the therapy in question. The interference with practice was indicated by the comparison of the During-test scores with the Pre-test scores. The mean of Pre-1 and Pre-2 indicates a decrease for both *CRT* and Tap while Pre-2 and During-1 means show a reversal in direction (significant [$P < .01$] only for Tap). An examination of the records of individual patients shows that 27 out of 34 (79 per cent) either slow down or do not change in *CRT*.

No relationship was found between the level or changes in *CRT* and Tap scores and the outcome improvement ratings. The group mean and *SD* of the *CRT* and Tap scores for the various test sessions are given in Table 2.

The change in *CRT* scores was not statistically significant between any of the test sessions. However the Tap Pre-2 (4.10 secs.) differs from the During-1 (4.20 secs.) at the $P < .05$ level.

4. *Critical Flicker-Fusion Thresholds*

It will be recalled that at each test period we obtained the mean of 10 ascending and of 10 descending thresholds at each of three levels of test patch luminance. This provided six *CFF* scores, expressed in cycles per second of light intermittence for each individual at each test session. There was no good presumptive reason for choosing any one group of measures or combination of groups of measures as a basis of ascertaining whether or not this indicator is affected by insulin coma therapy. We examined each of the group means obtained by each method, e.g., highest luminance, ascending method, etc., to see if any relationship could be found which would indicate that any group of measures was of greater significance in its relationship to other indicators, or to the course of treatment. No particular advantage was found. Hence we have averaged all six means obtained from all patients at each test session and used these figures, which are given in Table 2, for group comparisons.

It may be seen that the *CFF* scores for Pre-1, Pre-2, Post-1, Post-2, and Post-3 range between 42.8 and 43.6 cps; while all During- and Final-scores range between 41.2 and 41.5 cps. That is, there is no overlap of mean scores obtained during *IC* treatment with the mean scores obtained before or after treatment. Comparing back with the *CFF* measures supplied by the control group (Table 3) the mean of the Post-coma scores (\bar{c}) is 41.5 cps which is practically the same as the mean During-scores given in Table 2. The *SD* of these *CFF* means varies from 2.0 to 3.6 cps which reflects a wide range of individual measures.

The change in the group mean *CFF* at Pre-2 (42.9 cps) to that at During-1 (41.2 cps) was statistically significant ($P < .005$); that between Final (41.3 cps) and Post-1 (42.8 cps) was significant at the same level.

An inverse low, but not statistically significant correlation was found between Pre-2 *CFF* scores and the outcome rating. That is, patients with lower *CFF* measures just before insulin treatment tended to recover after treatment.

Since we had utilized both the ascending and descending method it was of interest to see whether or not the method used affected the mean of the thresholds. There were 1,166 instances where this comparison could be made. In 778 (67 per cent) instances the ascending method gave a higher

numerical value than the descending. This indicates that there is a tendency for an inertia-like phenomenon to prevail; if one is seeing flicker, the flicker tends to continue; while if the intermittent light seems steady, the steady appearance tends to continue. This phenomenon occurred in 61 per cent of comparisons based on measures made at 350 ml, in 64 per cent at 35 ml, and in 79 per cent at 3.5 ml. In a group of 16 normal controls (not otherwise used in this report) not one gave an ascending threshold which was significantly higher than the descending at 350 and 35 ml.

It would have been expected that the highest luminance, namely 350 ml, would be associated with higher frequencies than those associated with the medium luminance of 35 ml. For the ascending series this is true for 30 per cent of the comparisons, and for the descending series it is true for 40 per cent of the comparisons. This phenomenon of a brighter test patch producing a lower *CFF* threshold has been reported by other investigators particularly when a rather large and bright surround was employed. We believe that this reversal which we found in 30 to 40 per cent of our patients was due to the effect of the surround which we employed.

F. DISCUSSION

Essentially the direction and amount of change in test scores brought about by insulin coma in the present investigation agreed with those found in the previous report (1). We had hoped that a clearer relationship between test scores and blood sugar level might be found. What we did find was that low blood sugar level tended to interfere with the speed of reaction and of tapping but, under the conditions of this investigation, was not associated with change in the flicker-fusion threshold.

When the test scores for each individual patient at each session were correlated with the individual's blood sugar level for the same session, the correlations of *CFF* with sugar level ranged from 0.99 to -0.68 with a mean of 0.33; while three of the 36 correlations reached statistical significance. For *CRT* the range of individual correlations was 0.86 to -0.85 with a mean of -0.11 and no single individual measure reached statistical significance. For Tap the range was 0.87 to -0.99 with a mean of -0.16 and no one reaching statistical significance. Among the group mean comparisons blood sugar correlated with *CFF* 0.14, with *CRT* -0.09 , and with Tap 0.03.

G. SUMMARY

1. The flicker-fusion threshold, choice reaction time, and speed of tapping were obtained at regular intervals from a group of 47 psychiatric patients

before, during, and after they received insulin coma therapy. On days when this test battery was administered five blood sugar levels were determined, one at 7:00 A.M., before breakfast and/or treatment, one an hour after insulin injection, one before termination of coma, one after coma was terminated and the tests completed, and one shortly after luncheon. The reaction time and speed of tapping were significantly slower when the blood sugar level was below the normal range of 80 to 110 mg% by volume. The flicker-fusion threshold was not changed by low blood sugar; it was however lower after the coma had been terminated.

2. Statistically significant changes in group mean *CFF* scores occurred between the Pre-2 and the During-1 sessions and between the Final and Post-1 sessions. No significant changes in group mean *CRT* scores between sessions were found. The change in group mean Tap scores from the Pre-2 to the During-1 session was significant. The changes in all group mean test scores for all tests during the course of insulin treatment varied in a random fashion and never reached a level of significance.

3. The *CFF* measures were obtained at three levels of luminance and by both the ascending and descending method. Sixty-seven per cent of the ascending measures gave higher scores in cycles per second than were obtained by the descending method. Neither the method used nor the luminance of the test patch added to the direction or significance of the *CFF* changes as they are related to blood sugar level during insulin coma therapy.

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TWO GENERALIZED RATIO SCALING METHODS*

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A. INTRODUCTION

The "method of fractionation" was introduced by Stevens and his co-workers (6, 9, 12) as a means of establishing ratio scales (10) of subjective magnitudes. In this method, the subject is instructed to adjust a variable stimulus so that it appears subjectively equal to a certain fraction of the standard, usually half the standard. By means of a graphic procedure, subjective scale values (R) may be obtained from the readings of the adjusted stimulus as compared with the standard stimulus value (S). The "method of multiple stimuli" (5) is exactly the same, except that the subject is instructed to adjust the variable so that it appears equal to a certain multiple of the standard.

In the "method of constant sums," which was suggested by Metfessel (7) and formalized by Comrey (1), the subject is instructed to divide a certain number of points, usually 100, between two stimuli according to their subjective intensity. The ratings obtained are converted into ratios, and R values may be computed from these ratios.

Both types of method are fundamentally similar, in so far as the subject is working with ratios between subjective magnitudes. In the fractionation method and related methods, the subject is working with a constant, prescribed, ratio which he is to obtain by adjusting one of the two stimuli in each of a set of stimulus pairs. These methods may be treated together as a general *ratio setting method*. In the method of constant sums and related methods, on the other hand, the subject is working with pairs of prescribed standard stimuli, and his task is to judge the ratio between the two stimuli in each of the pairs. These methods are special cases of the general *ratio rating method*.

The purpose of the present paper is to describe certain generalizations and

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simplifications of the methods of ratio setting and ratio rating, and to illustrate the methods by application to experimental data.

B. THE RATIO SETTING METHOD

There is increasing evidence (11) that in many cases R is related to S by a power function, as was suggested by Guilford (5). In these cases, the computation of scale values may be obtained by an algebraic procedure which is considerably more sensitive than the usual graphic procedure.

Assuming a power function, R is related to S by the equation

$$R = c(S - S_0)^n, \quad (1)$$

where c is a constant related to the unit of measurement of R , S_0 is a kind of absolute threshold, and n is the exponent determining the curvature of the function. Figure 1 *A* illustrates a function where n is greater than unity.

In the ratio setting method, the subject adjusts the variable stimulus to a value, S_p , which, subjectively, is p times that of the subjective value of the standard S . (In Figure 1 *A*, $p = 1/2$.) In the form of an equation,

$$pR = c(S_p - S_0)^n. \quad (2)$$

Combining (1) and (2) and solving for S_p ,

$$S_p = S_0(1 - k) + kS, \quad (3)$$

where

$$k = p^{1/n}. \quad (4)$$

The hypothesis of a power function may thus be tested by plotting the experimentally obtained values of S_p against the standard stimulus values S . If the plot is not linear, the hypothesis is not accepted and the usual graphic procedure has to be applied. If the plot is linear, the hypothesis is accepted. The exponent may then be computed by determining the slope, k , of the straight line, and solving equation (4) for n ,

$$n = \frac{\log p}{\log k}. \quad (5)$$

Since k is known, equation (3) may be solved for S_0 ,

$$S_0 = \frac{S_p}{1 - k}, \quad (6)$$

where S_p is the intercept when $S = 0$. The straight line resulting from the plot of S_p against S is illustrated in the lower part of Figure 1 *A*.

Scale values are obtained by subtracting S_0 from the physical values of S , taking logs of these differences, multiplying the logs by n according to equation (1), and finally taking antilogs. These are equal to R in an arbitrary unit.

One advantage of the algebraic method becomes especially clear in connection with shifting functions. Such cases have been reported (8, 13) and may be predicted, e.g., for scotopic and photopic brightness.

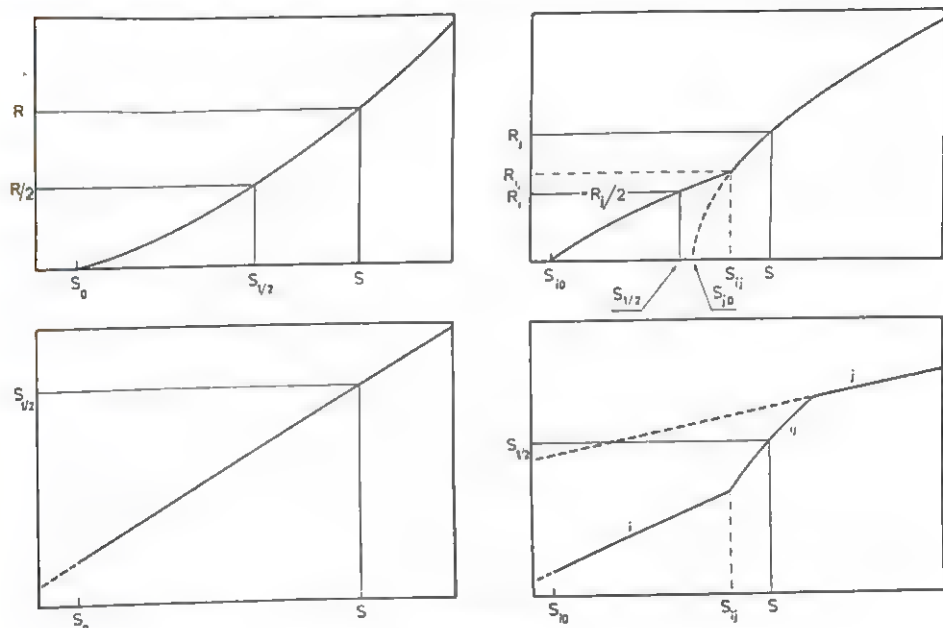


FIGURE 1
A, left; B, right

Consider Figure 1 B. The upper part of the graph illustrates a case where the curve relating R to S may be separated in two parts, determined by two power functions, R_i and R_j , intersecting at R_{ij} and S_{ij} respectively, with exponents m and n and with the thresholds S_{i0} and S_{j0} . These functions may be investigated as above. They are represented by the straight lines i and j in the lower part of Figure 1 B. In this diagram $p = 1/2$.

The straight line j , however, will apply only to S values connected with R values which are greater than R_{ij}/p . There is an intermediate range, ij , where the relation of S_p to S , in general, is not linear. Consider the upper part of Figure 1 B. A stimulus S evokes the response R_j . In this case

$pR_j = R_i$, which is on the first part of the composite curve. Proceeding as above, we may show that

$$S_p = S_{i0} + k_{ij}(S - S_{j0})^{n/m}, \quad (7)$$

where

$$k_{ij} = (pc_j/c_i)^{1/m}. \quad (8)$$

Equation (7) is analogous to Equation (3), but it is not linear, except for the special case $m = n$. When the experimental range includes sufficient parts of the two straight lines i and j , the two power functions may be solved without resort to Equation (7). The arbitrary units are to be chosen so that $R_i = R_j$ at the point of intersection, which may be graphically determined.

C. THE RATIO RATING METHOD

The task of dividing a certain number of points between the two stimuli may appear somewhat artificial to the subject. In our variation of the method, the subject is instructed to rate directly the subjective ratio on a percentage scale, e.g., "The first weight appears 60 per cent as heavy as the second one." This is only a minor modification.

Another limitation of the method of constant sums is the requirement that every stimulus be compared with every other stimulus. The generalized ratio rating method to be described below allows a greater variety of designs and makes some interesting new kinds of experiment possible. The computational procedure is also considerably simplified.

The set of stimuli to be investigated is divided in two groups. Let there be m stimuli, S_{ai} , in Group A ; and n stimuli, S_{bj} , in Group B . The total number of stimuli, then, is $m + n$.

Each stimulus in Group A is compared with every stimulus in Group B , and ratio ratings are obtained. If the two groups do not overlap, there will be $m \times n$ ratios. Any cell of the matrix contains the ratio of the subjective value, R_{ai} , of the stimulus of the row, to the subjective value, R_{bj} , of the stimulus of the column.

The sums of any row, Σ_{ri} , and any column, Σ_{cj} , and the total sum, T , of the matrix are given by the equations

$$\Sigma_{ri} = R_{ai} \Sigma (1/R_{bj}), \quad (9)$$

$$\Sigma_{cj} = (\Sigma R_{ai}) / R_{bj}, \quad (10)$$

$$T = (\Sigma R_{ai}) \Sigma (1/R_{bj}). \quad (11)$$

If the arbitrary unit of measurement is so chosen that $\Sigma (1/R_{bj}) = 1$,

and ΣR_{ni} is eliminated by dividing Equation (11) by Equation (10), we obtain the simple formulae

$$R_{ni} = \Sigma r_i, \quad (12)$$

$$R_{bj} = T / \Sigma c_j, \quad (13)$$

i.e., the scale value corresponding to a certain row is obtained by summing this row, and the scale value corresponding to a column is found by dividing the sum total by the sum of this column.

The method is completely general in so far as division of the stimuli into two groups is concerned. In the case of *identical groups*, the general method reduces to the special form where every stimulus is compared with every other stimulus. Equations (12) and (13) will then yield two sets of scale values for the same stimuli. These sets will not be identical because of error variance. They may be averaged. In this case, however, a more direct computational procedure is recommended. Dividing Equation (9) by Equation (10), when $R_{ni} = R_{ij} = R_i$, solving for R_i and taking $(1/\Sigma R_i)\Sigma(1/R_i)$ as the arbitrary unit,

$$R_i = (\Sigma r_i / \Sigma c_i)^{1/2}, \quad (14)$$

i.e., in the case of identical groups the scale value belonging to any stimulus is obtained by dividing the sum of the row of that stimulus by the sum of the corresponding column and taking the square root of the ratio.

The grouping of stimuli may be made with the purpose of reducing the number of combinations to be rated or the subjective range to be covered by a ratio rating. Above all, it is possible to obtain two separate scales for stimuli, whether identical or not, which are compared under two different conditions. The two groups may include stimuli presented simultaneously to various parts of the body—weights lifted by the right and left hand or pain stimuli applied to one normal and one anaesthetized area. Or, Group *A* may consist of stimuli which are presented first in the pairs and Group *B* of those which are presented second in the pairs. Thus it is possible, e.g., to obtain measures on the subjective continuum of adaptation effects and so called time order errors.

D. AN EXPERIMENTAL ILLUSTRATION

In this experiment, the *subjective size* of various circular surfaces was measured by both methods. Two illuminated circular surfaces were shown side by side on a translucent screen. The size of any surface could be varied by turning a knob. The distance between the centres of the surfaces was 160 mm. The distance from the subject's eyes to the centre of the screen was 750 mm.

Under Condition 1, the ratio setting method was used. The subject had to adjust the variable surface until it appeared half as large as the standard. Five standard surfaces were selected: 5.3, 11.9, 21.2, 33.2, and 47.8 cm.²

Under Condition 2 the ratio rating method was used with identical groups. With the same five stimuli there were 10 comparisons.

Five students of psychology took part in the experiment. Three of them began with Condition 1 and the others with Condition 2. Under Condition 1 each subject made 10 adjustments for each standard. Right and left position, as well as ascending and descending adjustments, were rotated. The order of standard stimuli was randomized. Under Condition 2, each subject made four judgments for each combination. The order of stimulus pairs was randomized.

The results of the experiment using the *ratio setting* method are shown in the first two columns of Table 1. These two columns are plotted in

TABLE 1
RATIO SETTING DATA

Standard stimulus	Stimulus set half	Scale value
5.3	2.3	4.2
11.9	5.3	8.4
21.2	9.5	13.8
33.2	14.5	20.3
47.8	21.4	27.7

Figure 2 A. The fit of a straight line is almost perfect. Thus, the hypothesis of a power function has to be accepted, and the algebraic procedure may be applied.

The least squares solution of the straight line is

$$S_{\frac{1}{2}} = -0.076 + 0.446S.$$

Applying the constants of this equation in Formulae (5) and (6), Equation (1) may be written

$$R = (S + 0.137)^{0.858},$$

and the scale values corresponding to the standard stimuli have been computed from this equation; they are shown in the last column of Table 1. When the lowest scale value is taken as the arbitrary unit, we obtain the final scale shown in the second column of Table 4. With this unit, the equation is illustrated by the curve in Figure 2 B.

Means of the *ratio ratings* are shown in Table 2 with scale values computed from Formulae (12) and (13) in the last column and last row.

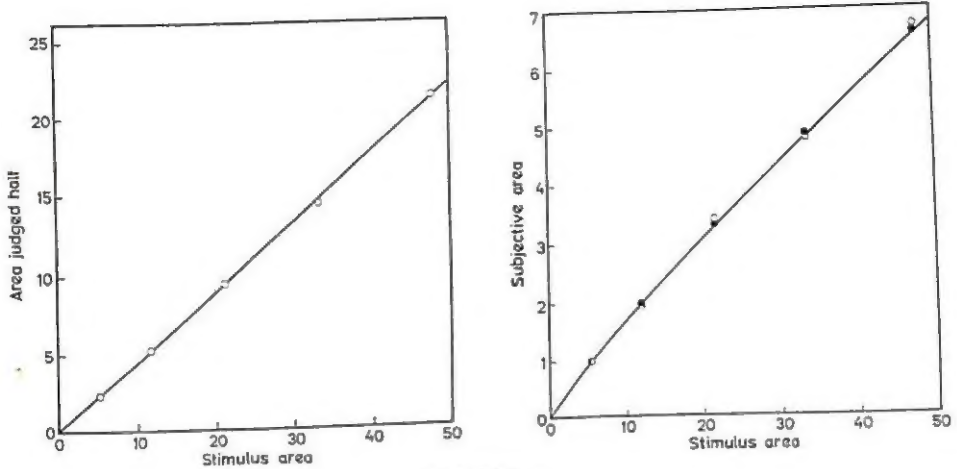


FIGURE 2
A, left; B, right

Since this experiment included identical groups, we would ordinarily prefer Formula (14). When this is applied, and the lowest scale value is taken as the arbitrary unit, we obtain the scale shown in the third column of Table 4.

In order to illustrate the ratio rating method in its general form, where groups of stimuli are not identical, part of the data of Table 2 are shown in Table 3, where two stimuli are compared only with the three remaining stimuli. Scale values are computed according to Formulae (12) and (13).

TABLE 2
RATIO RATING DATA FROM IDENTICAL STIMULUS GROUPS

	Stimulus value					Σ_r
	5.3	11.9	21.2	33.2	47.8	
5.3	1.00	0.52	0.29	0.19	0.16	2.16
11.9	1.92	1.00	0.62	0.43	0.31	4.28
21.2	3.45	1.61	1.00	0.70	0.49	7.25
33.2	5.26	2.33	1.43	1.00	0.70	10.72
47.8	6.25	3.23	2.04	1.43	1.00	13.95
Σ_c	17.88	8.69	5.38	3.75	2.66	38.36
T/Σ_c	2.15	4.41	7.13	10.23	14.42	

Again the lowest scale value is taken as the arbitrary unit, and the final scale thus obtained is found in the last column of Table 4.

Table 4 now contains three scales, one from ratio setting and two from ratio rating. The scale values from ratio rating with identical groups are shown as filled circles in Figure 2 B, and those from ratio rating with different groups are shown as empty circles in the same graph, where the

curve represents the scale obtained by ratio setting. The agreement between these three scales is rather close.

TABLE 3
RATIO RATING DATA FROM DIFFERENT STIMULUS GROUPS

	5.3	Stimulus value		Σ_r
		33.2	47.8	
11.9	1.92	0.43	0.31	2.66
21.2	3.45	0.70	0.49	4.64
Σ_c	5.37	1.13	0.80	7.30 = T
T/Σ_c	1.36	6.46	9.13	

TABLE 4
SUMMARY OF SCALING RESULTS

Standard stimulus	Ratio setting	Ratio rating	
		Identical groups	Different groups
5.3	1.00	1.00	1.00
11.9	1.99	2.01	1.96
21.2	3.25	3.33	3.41
33.2	4.78	4.86	4.75
47.8	6.53	6.58	6.71

E. SUMMARY

1. Two methods for psychophysical ratio scaling have been compared. The *ratio setting* method includes the fractionation method and the method of multiple stimuli. The *ratio rating* method includes the method of constant sums and a variation of this method where the ratio is directly estimated.
2. An algebraic procedure is developed for obtaining scale values from ratio setting data. It applies when R is a power function of S and is then considerably more sensitive than the common graphic procedure. It is also applicable to data involving a functional shift.
3. A generalized ratio rating method is described. Stimuli are divided into two groups which may or may not contain identical stimuli, and comparisons are made only between groups. Simple computational formulae are developed. Examples of scaling designs are discussed. Most important is that the same stimuli may be scaled under different experimental conditions.
4. The ratio setting method and the ratio rating method are applied in an experiment on subjective area. Scales from two variants of the ratio rating method show a close agreement with each other and with the scale from ratio setting.

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